

AD-A152 694

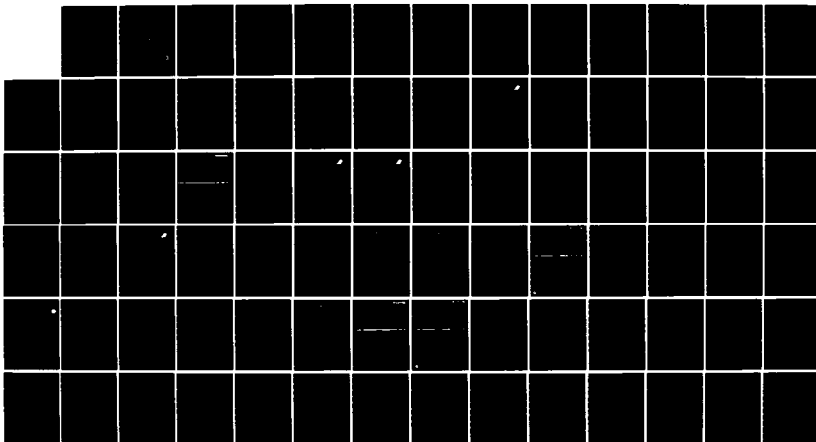
FABRICATION OF DIGICONS FOR THE SHAD EXPERIMENT(U)  
SCIENCE APPLICATIONS INTERNATIONAL CORP SAN DIEGO CA  
31 DEC 84 SAIC-84/1842 N00014-82-C-0363

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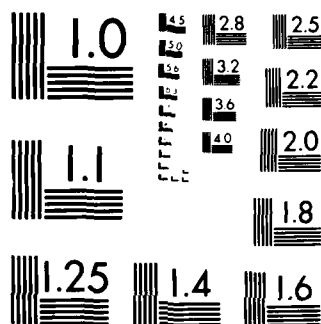
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MICROCOPY RESOLUTION TEST CHART  
NATIONAL BUREAU OF STANDARDS 1963-A

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AD-A152 694

FABRICATION OF DIGICONS  
FOR THE  
SHAD EXPERIMENT

FINAL REPORT

Contract N00014-82-C-0363

science applications, inc.

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FABRICATION OF DIGICONS  
FOR THE  
SHAD EXPERIMENT

FINAL REPORT

Contract N00014-82-C-0363

December 31, 1984

Prepared by:

Science Applications International Corporation  
Electronic Vision Systems Division  
11526 Sorrento Valley Road  
San Diego, California 92121

Prepared for:

Office of Naval Research  
Department of the Navy  
800 North Quincy Street  
Arlington, Virginia 22217

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10401 Roselle Street, San Diego, California 92121

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## 1.0 PURPOSE

The purpose of this program is to provide the necessary personnel and facilities required to design, fabricate, test, and deliver the intensified quadrat photomultiplier tubes (Digicons) required to support the SHAD experiment. Deliverables included two (2) breadboard tubes, three (3) space-qualified tubes, reports, and data.

All work ~~required~~ by this contract has been accomplished. Two (2) breadboard tubes were fabricated, the design verified through testing and the tubes delivered. Three (3) space-qualified tubes have been fabricated, tested, and delivered. All reports and data requirements will have been satisfied with the ~~submittal~~ of this final report.

## 2.0 SHAD DIGICON DESIGN

### 2.1 BACKGROUND

The design of the quadrant photo tube for the SHAD Experiment was derived from the quadrant Digicon guider tube developed by SAIC under contract to the University of Maryland.

The Digicon tube is an imaging tube with a photocathode as an electron source on one end and a monolithic silicon photodiode array as a detector on the other end (Fig. 1). Electrons produced by incoming photons at the photocathode are accelerated by an electrostatic field and detected by the diode array. Each photodiode serves as the high-gain first stage of a detector channel, producing a charge pulse of approximately 5000 electron-hole pairs for each incident photoelectron. Each current pulse is amplified by a charge sensitive preamplifier and is "counted" if it exceeds a preset discriminator threshold level. The Digicon is characterized by a wide dynamic range, low noise, high photometric accuracy, and high reliability.

### 2.2 SHAD DESIGN

The design goals for the SHAD Flight-Qualified tube are listed in Table 1. In order to satisfy them, revisions were made to the internal tube structure making it more compatible with the vibration environment to be encountered. The quadrant diode array design was revised to specify the tighter inter-diode spacing recommended by Dr. Currie. See Fig. 2 SAIC Drawing No. 131-18-111-203.

The packaging and encapsulation design was completely revised for this application. The magnetic shield was redesigned to provide a closed shield. The encapsulant and HV cables were changed in order to be compatible with the requirement for use of space-qualified materials, and the method of attaching the High Voltage cable revised to accommodate the spacecraft's environmental requirements.



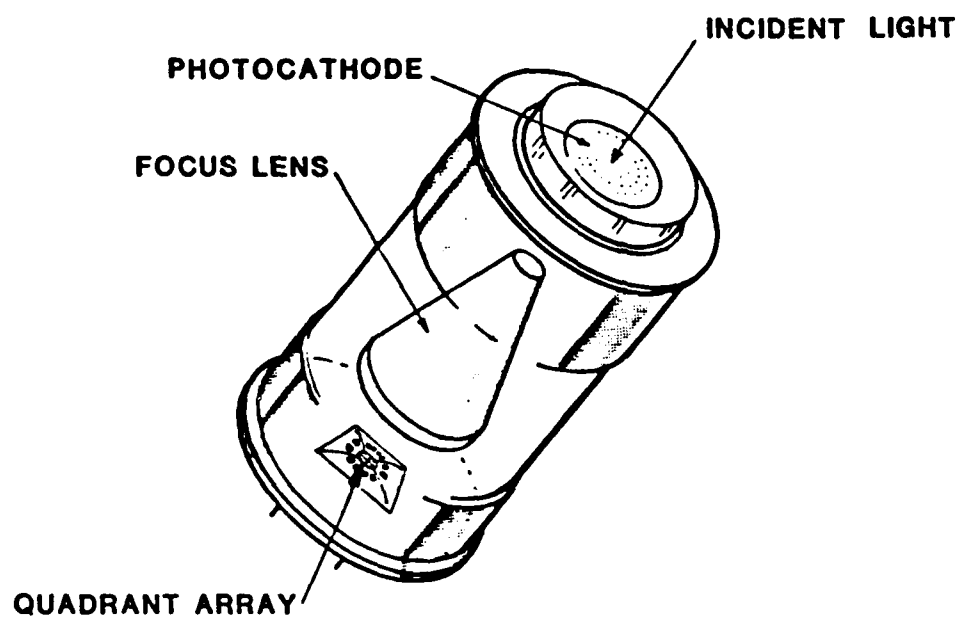


Figure 1. Quadrant Digicon—Unencapsulated View.

Table 1. SHAD Quadrant Digicon Performance Goals.

1. PHYSICAL (See Figure 4)

- Length  $3.50'' \pm 0.01''$
- Diameter  $2.00'' \pm 0.01''$
- Weight  $\leq 350$  grams
- Array Configuration See Fig. 2

2. ELECTRICAL

- Diode Leakage Current (6V Reverse Bias)  $\leq 1$  nA (4 central diodes)
- Diode Capacitance (6V Reverse Bias)  $\leq 15$  pf (4 central diodes)
- $\Delta E/E$  at 15 kV  $\leq 0.25$  (4 central diodes)

3. PERFORMANCE AT 15 kV

- Photocathode Quantum Efficiency
 

400 nm	25%
500 nm	15%
700 nm	2.5%
800 nm	0.1%
- Dark Count  $\leq 25$  ct/sec/diode (avg of 4 central diodes)
- Magnification  $0.6 < m < 1$
- Error Function (10-90%)  $50\mu$
- Uniformity (4 central diodes)  $\pm 5\%$

4. ENVIRONMENTAL

- Vacuum Operation Compatible
- Temperature  $-40^{\circ}\text{C}$  to  $+55^{\circ}\text{C}$
- Vibration See SHAD Vibration Levels

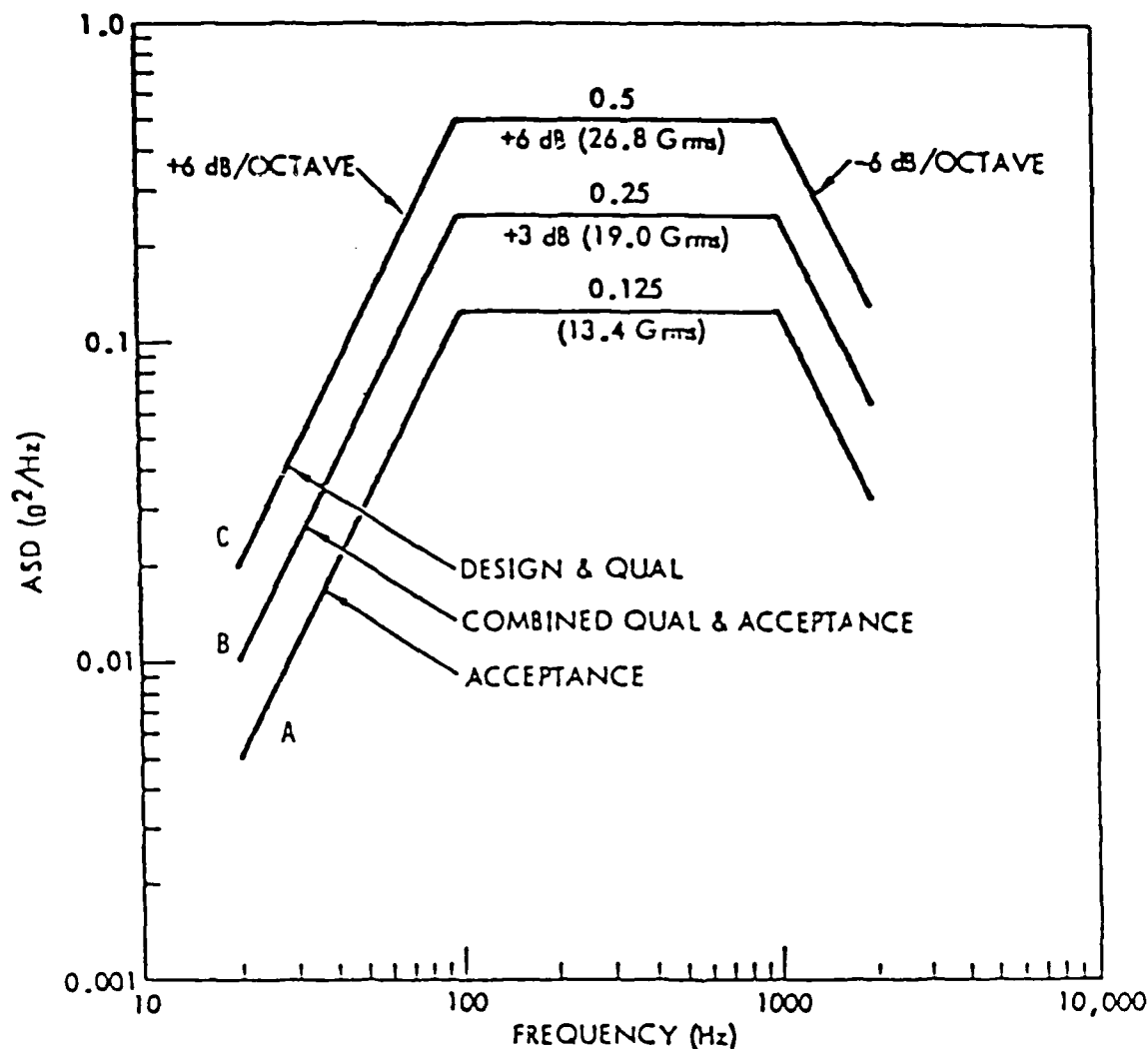


Figure 5. SHAD Vibration Levels

# INTERFACE CONTROL DOCUMENT

DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND  
 HING HEREIN CONTAINED SHALL BE DEEMED TO ALTER  
 TERMS OF ANY CONTRACT OR PURCHASE ORDER BE-  
 N ALL PARTIES AFFECTED

SIZE

A

CODE IDENT NO.

03953

DRAWING NO.

MH09-00006-400

SCALE

REV

SHEET 10 OF



The encapsulation technique has been described in detail in a report to ONR, SAI-83/1421, dated December 1, 1983. The final encapsulated tube assembly is shown in Fig. 3, SAIC Drawing No. 131-18-110-000. The interface drawing, SAIC Drawing No. 131-18-110-001 is provided in Fig. 4.



3.a

DUU

TUBE NO. 673-5 12KV

DATE 5/17/84

### DIGICON PERFORMANCE

a. MAGNIFICATION

DIODE (2)

	1/2	CENTER	1/2
$\mu$ Divisions	<u>5510<math>\mu</math>m</u>	<u>5070<math>\mu</math>m</u>	<u>4850<math>\mu</math>m</u>
Count Rate	<u>1926</u>	<u>3965</u>	<u>1925</u>
S (Total No. Divisions)	<u>                    </u> = <u>660<math>\mu</math>m</u>		
W = S * ( $\mu$ /Divisions)	<u>                    </u> * <u>                    </u> = <u>                    </u>		
M (Magnification) = D/W	<u>400<math>\mu</math>m</u> / <u>660<math>\mu</math>m</u> = <u>.606</u>		
(D = Diode Width)			

DIODE (1)

	1/2	CENTER	1/2
$\mu$ Divisions	<u>4890<math>\mu</math>m</u>	<u>4450<math>\mu</math>m</u>	<u>4240<math>\mu</math>m</u>
Count Rate	<u>1925</u>	<u>4290</u>	<u>2072</u>
S (Total No. Divisions)	<u>                    </u> = <u>650<math>\mu</math>m</u>		
W = S * ( $\mu$ /Divisions)	<u>                    </u> * <u>                    </u> = <u>                    </u>		
M (Magnification) = D/W	<u>400<math>\mu</math>m</u> / <u>650<math>\mu</math>m</u> = <u>.615</u>		
(D = Diode Width)			

(Average Magnification  $\left(\frac{M_1 + M_2}{2}\right)$  = .610 Goal =  $0.6 < M < 1$ )

TEST ENGINEER L. Acton 5-17-84 QA SAIT  
QE4 5/17/84

CUSTOMER (if applicable) N/A

Focus Position 1.0250 cm

18-4.2  
ge 7

TUBE NO. 673-5

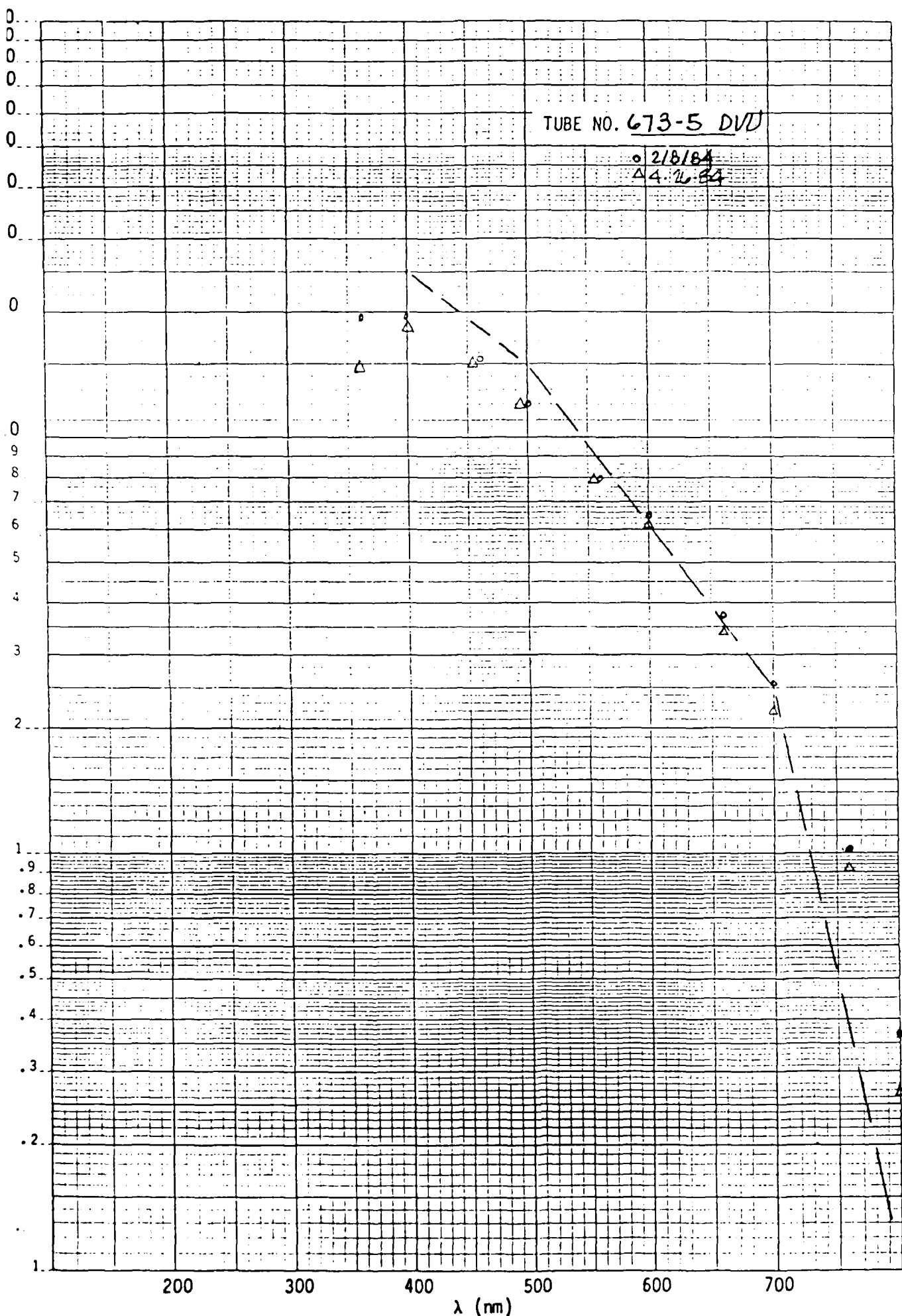
DATE 5/29/84

QUAD DIGICON ARRAY RESPONSE

DIODE	PIN	LEAKAGE CURRENT (nA) Goal $\leq 1$ nA	CAPACITANCE (pf) Goal $\leq 15$ pf	$\Delta E/E$ Goal $\leq 0.25$
Q1	2	0.11	10.8	0.29
Q2	5	0.16	10.7	0.29
Q3	9	0.08	10.4	0.30
Q4	12	0.08	10.0	0.28
G1	1	0.04	8.6	0.29
G2	3	0.09	7.7	0.30
G3	4	0.15	6.9	0.30
G4	6	0.14	6.8	0.27
G5	8	0.06	8.4	0.28
G6	10	0.05	8.0	0.28
G7	11	0.04	8.8	0.27
G8	13	0.03	7.1	0.27

SAIT  
QEA  
5/29/84





TUBE NO. 673-5 DVUDATE 4.26.84ENCAPSULATED  
IN SHIELD

## PHOTOCATHODE RESPONSE

Visible Current Mode Quantum Efficiency Data Sheet

Wave- Length (nm)	Tube Signal (A)	Calibration Standard Signal (A)	Standard Calibration (QE%)	Comments	Calculated QE (%)	Goal QE (%)
	$\sqrt{E}$	$\sqrt{E}$				
360	.36 $\sqrt{E}$	.47 $\sqrt{E}$	19.3	BLUE FILTER	14.8	
400	.625 $\sqrt{E}$	.521 $\sqrt{E}$	15.4		18.5	25.0
460	1.68 $\sqrt{E}$	1.17 $\sqrt{E}$	10.5		15.1	
500	.765 $\sqrt{E}$	.496 $\sqrt{E}$	7.96	NO FILTER	12.3	15.0
560	.349 $\sqrt{E}$	.539 $\sqrt{E}$	5.09		5.02	
600	.755 $\sqrt{E}$	.468 $\sqrt{E}$	3.86	YELLOW FILTER	6.23	
660	.570 $\sqrt{E}$	.375 $\sqrt{E}$	2.52		3.83	
700	.380 $\sqrt{E}$	.268 $\sqrt{E}$	1.72		2.44	2.5
760	.522 $\sqrt{E}$	.411 $\sqrt{E}$	.726		.922	
800	.126 $\sqrt{E}$	.111 $\sqrt{E}$	.245		.278	0.1

Test Engineer E. Ugin

QA

SAIT  
QE4

4/26/84

Customer (if applicable)

N/ACalculated QE% =  $\frac{\text{Tube Signal}}{\text{Calibration Standard Signal}} \times \text{Standard Calibration QA\%}$

ENCAPSULATED DIGICON ACCEPTANCE TESTS (SHAD)

DIGICON NO. 673-5 DVU

<u>TEST</u>		<u>DATE</u>
4.1	PHOTOCATHODE RESPONSE (QE)	<u>4/26/84</u>
4.2	DIODE ARRAY RESPONSE	
	a. Leakage	<u>5/29/84</u>
	b. Capacitance	<u>5/29/84</u>
	c. $\Delta E/E$	<u>5/29/84</u>
4.3	DIGICON PERFORMANCE	
	a. Magnification	<u>5/17/84</u>
	b. Error Function	<u>5/17/84</u>
	c. Dark Count	<u>5/17/84</u>
	d. Uniformity	<u>5/17/84</u>
4.4	PHYSICAL	
	a. Diameter	<u>5/25/84</u>
	b. Length	<u>5/25/84</u>
	c. Centering	<u>5/25/84</u>
	d. Weight	<u>5/25/84</u>

Data Distribution:

- ☐ Test Build Log Book
- ☐ Test Lab
- ☐ Tube Engineer
- ☐ Quality Assurance
- ☐ Customer
- ☐ File

May 30, 1984



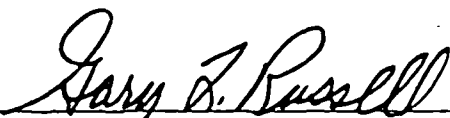
SHAD QUAD DIGICON [1-131-08-645]

SAI P/N: 131-18-110-000  
S/N: 673-5 (DVU)

Contract No: N00014-82-C-0363  
Office of Naval Research

CERTIFICATE OF PERFORMANCE

This is to certify that the item noted was tested in accordance with the SAI Acceptance Test Procedure AT-18-4.1- Photocathode Response (QE), AT-18-4.2A- Diode Array Response, AT-18-4.3A- Digicon Performance, and AT-18-4.4- Physical, Mechanical Dimensions. Test Data Summary Sheets are attached for each test. Physical test reports and data on file at this facility and are available for review by ONR.

  
\_\_\_\_\_  
Gary L. Russell  
Quality Assurance

Distribution: SAI Test  
SAI QA  
SAI Contracts (4)  
SAI File

**Science Applications, Inc.** 11526 Sorrento Valley Road, Suite A, San Diego, California 92121, (619) 458-3700

Other SAI Offices: Albuquerque, Ann Arbor, Arlington, Atlanta, Boston, Chicago, Huntsville, La Jolla, Los Angeles, McLean, Palo Alto, Santa Barbara, Sunnyvale & Tucson

SERIAL NUMBER 673-5

DESIGN VERIFICATION UNIT (DVU)

APPENDIX A

SHAD SPACE-QUALIFIED TUBES TEST DATA

673-5	Design Verification Unit (DVU)
676-5	First Flight Tube (F-1)
691-5	Second Flight Tube (F-2)
674-5	Third Flight Tube (F-3)
672-5	Unencapsulated Tube (Spare)

All tests were monitored by both SAIC Quality Engineering and the appointed Government representative.

Test data is included in Appendix A.

#### 3.2.4 Space-Qualified Tube Delivery

The Design Verification Unit (DVU) was delivered to ONR at ITE, Beltsville, Maryland on June 1, 1984.

Following selection by ONR, Tube S/N 676-5 was selected to be encapsulated into the first Space-Qualified Tube (F-1). This tube was delivered on June 6, 1984.

Following the processing and testing of the redder photocathode tubes, Tube S/N 691-5 and S/N 674-5 were selected for use in the second and third Space-Qualified Tubes (F-2 and F-3). These tubes were delivered on October 8, 1984 and December 3, 1984, respectively.

Tube S/N 672-5, which is a good operating device but not selected for use as a deliverable flight tube, is still unencapsulated. It is being held in SHAD residual inventory at SAIC.

<u>Tube Run No.</u>	<u>Tube S/N</u>	<u>Results</u>	<u>Assignment/Use</u>
4	672-5	Good Tube	Hold in Residual
5	673-5	Good Tube	DVU Tube
6	674-5	Good Tube	F-3 Tube
7	676-5	Good Tube	F-1 Tube

At this point SAIC was directed to attempt a "redder" photocathode. Three cathode tests were performed on S/N 686, 688 and 690. Then the last two tube runs were made using the "redder" photocathode process.

8	691-5	Good Tube	F-2 Tube
9	695-5	Noisy Tube	Scrap

### 3.2.3 Space-Qualified Tube Testing

Testing of the Space-Qualified Tubes was performed in accordance with the SHAD Test Plan, TP 131-08-645-01, Rev. A, and the SHAD Acceptance Test Procedures, AT 18-4.0, AT 18.1, AT 18.2, AT 18.3, and AT 18.4. Testing included the following:

- Manufacturing Tests
  - Incoming Inspection
  - In-Process Inspection
- Unencapsulated Digicon Tests
  - Photocathode Response
  - Diode Response
  - Digicon Performance
  - Physical Inspection
- Encapsulated Digicon Tests
  - Photocathode Response
  - Diode Response
  - Digicon Performance
  - Physical Inspection

Unencapsulated tests were performed on all tubes produced. Encapsulated Tube Acceptance Tests were performed on the Design Verification Unit (DVU) and on the three flight tubes delivered (F-1, F-2, and F-3).



The encapsulated tube design was revised, modifying the anti-corona shield and the potting/installation techniques.

The first SHAD breadboard tube was re-encapsulated in the revised configuration which successfully passed thermal cycling between +55°C and -45°C. This tube was delivered to ONR at ITE, Beltsville, Maryland on October 5, 1983 for integration testing.

The second breadboard tube (S/N 651-5) was encapsulated in the new configuration. It received functional performance testing, thermal cycling, and vibration testing, passing all successfully. This tube was delivered to ONR at ITE on October 6, 1983.

### 3.2 SPACE-QUALIFIED TUBES

#### 3.2.1 Space-Qualified Parts Procurement

The parts for fabrication of the Space-Qualified Tubes were procured under a separate contract, N00014-82-C-0708. All parts were received, inspected, and tested. We found, upon testing, that the diode arrays fabricated for these tubes failed during vacuum bake. After several reworks and weeks of delays, the problems being experienced (with metalization) were identified, and we received usable diode arrays.

#### 3.2.2 Space-Qualified Tube Fabrication

Nine tube runs were completed for the fabrication of Space-Qualified tubes. The sequence and results are listed below:

<u>Tube Run No.</u>	<u>Tube S/N</u>	<u>Results</u>	<u>Assignment/Use</u>
1	661-5	Indium Seal Failure	Scrap
2	670-5	Diodes High Leakage	Scrap
3	671-5	Diodes High Leakage/Seal	Scrap

At this point the diode problem was identified and corrected.

### 3.0 HARDWARE FABRICATION AND TESTING

#### 3.1 BREADBOARD TUBES

The first phase of this program was to design, fabricate, encapsulate, and test two (2) breadboard tubes of the design to be used in the space-qualified devices to follow.

##### 3.1.1 Breadboard Tube Fabrication

The two breadboard quadrant tubes were fabricated successfully and tested for operation. These were, respectively, S/N 638-5 and 651-5.

Tube S/N 638-5 was selected for encapsulation processing and test while S/N 651-5 was designated the life and environmental test unit. The Life Test was performed on this tube with no unacceptable degradation of performance after the scheduled accumulation of  $10^{12}$  electrons.

##### 3.1.2 Breadboard Tube Encapsulation and Testing

The encapsulation process for the SHAD flight Digicons was developed using space-compatible materials based on experience with the University of Maryland quad guider tubes and with the ST FOS flight Digicons. This process was tested on a non-operating tube and the problems initially encountered with material compatibility, adhesion, and surface preparation worked out. Following successful processing of non-working tubes, the first SHAD breadboard tube, S/N 638-5, was encapsulated using this process. Post-encapsulation testing revealed that the tube was no longer operational. We dissected the tube and found that the indium seal had failed, most probably during the encapsulant's cure cycle. It appears that the force on the tube's anti-corona shield due to differential expansion during the potting cure was sufficient to mechanically force the faceplate from its indium seal. Additional problems were found during thermal testing of the encapsulated assembly.

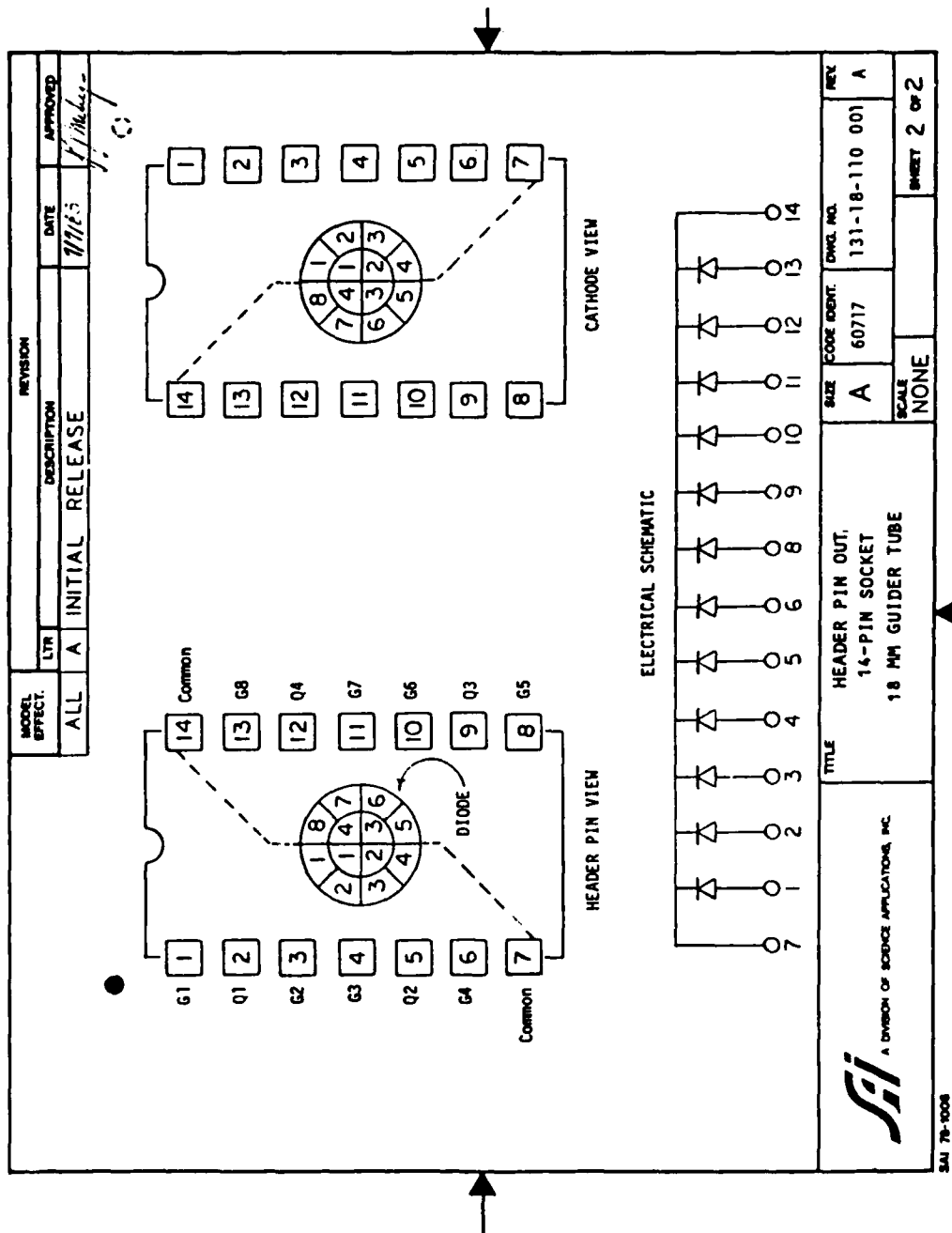


Figure 4 (Continued).

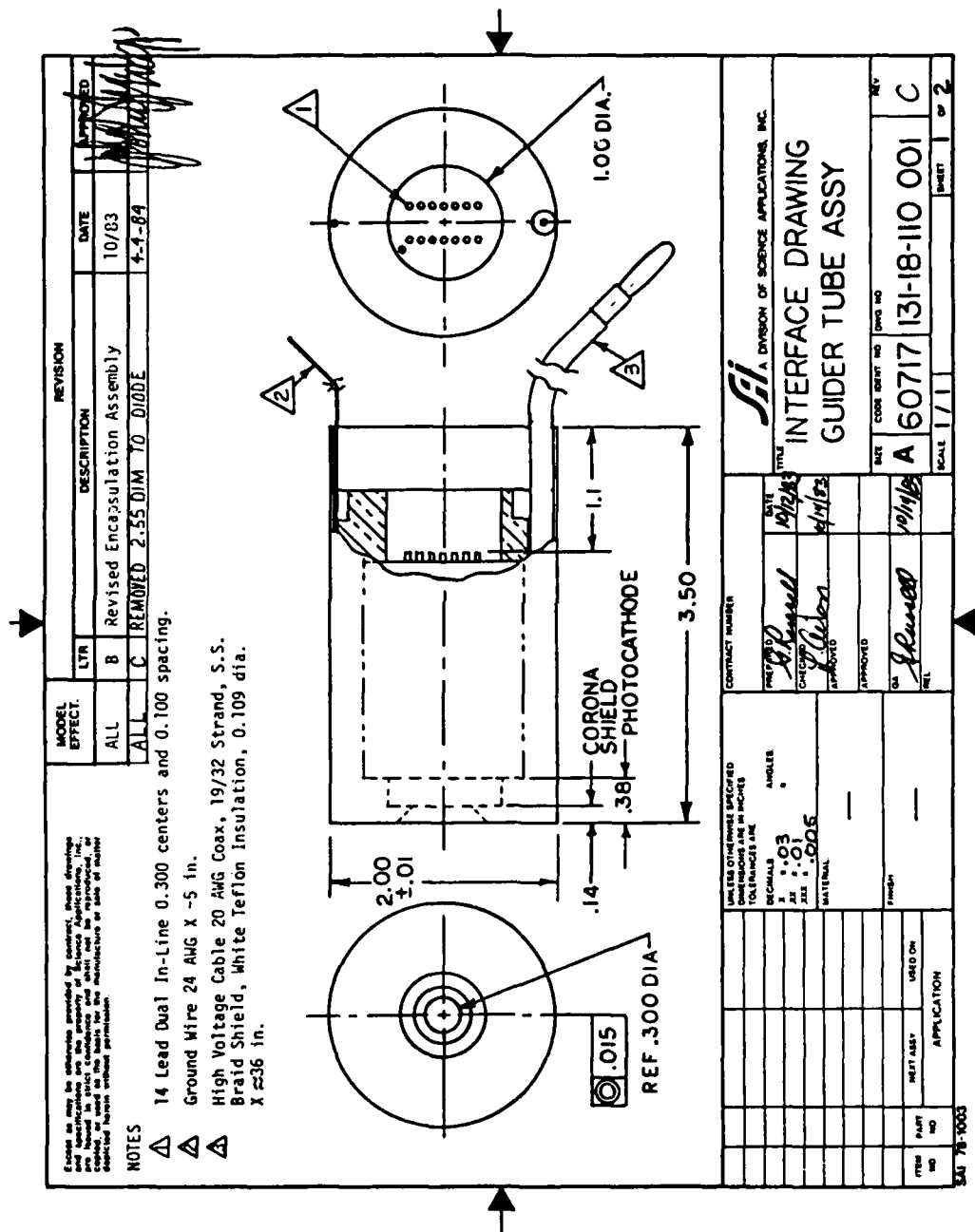
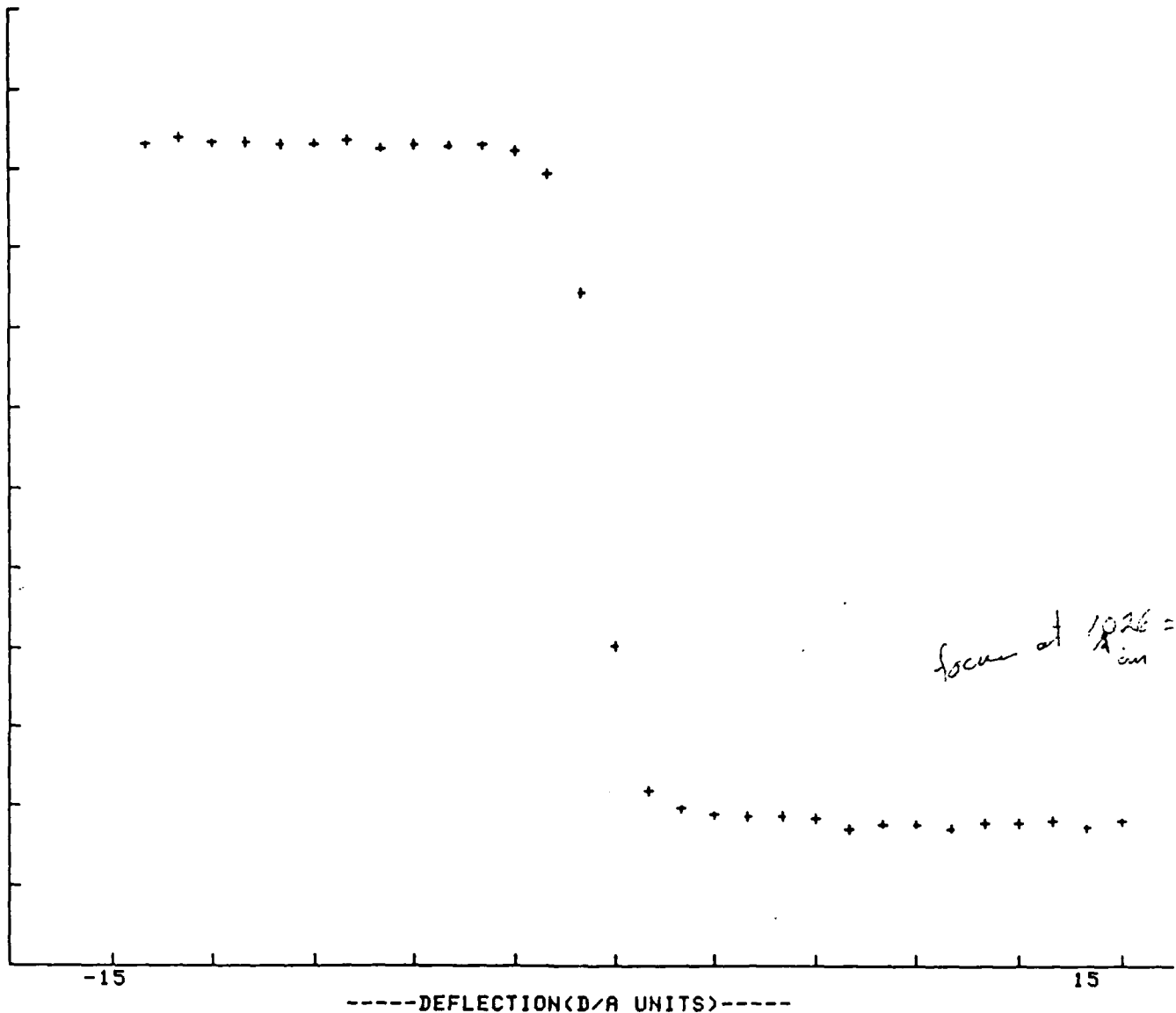


Figure 4. SAIC Drawing No. 131-18-110 001.

673-5 DUU

5/17/84

PREAMP No. 1 COUNTER No. 18 DIODE No. 1 THRESHOLD = 84  
 SCALE MAX, SCALE MIN = 20000 0



Hfm1, Hfm2, FWHM, Pos. = -14.41 - .46 13.95 -7.44  
 10%-90%, 90%-10%, AVE = .67 2.46 1.57  
 MAX COUNT, MIN COUNT = 20704.6 3523.06

STD. DEV OF EFUN = .836020563172  
 SUMSUM = 4220.86666667  
 MEAN EFUN = -4.15192341003E-02  
 \*\*\*QUAD08(7/24/83)\*\*\*



5/17/84

Preamp. No.	1	2	3	4	5	6	7	8	9	10	11
Counter No.	18	19	21	22	20	23	24	25	29	27	26
Diode No.	1	2	3	4	0	0	0	0	0	0	0
Threshold	84	100	80	70	254	254	254	254	254	254	254

DEFLECTION FACTORS: X= 6.25 Y= 6.25 (MICRONS PER D/A)

5 / 17 /83  
 QUAD TUBE SCAN

15 : 26

( 54 Sec.)

4.3.c,d

DVU  
TUBE NO. 673-5 16KV  
DATE 5/17/84

DIGICON PERFORMANCE

c. 100 SECOND INTEGRATION DARK COUNT

Q1 = 26731

Q2 = 26313

Q3 = 25113

Q4 = 25787

TOTAL = 104944

C = TOTAL/400 = 262  
(Goal = 25)

d. QUADRANT RESPONSE UNIFORMITY

100 SECOND COUNT TO 5100

% AVG

Q1 4217 +2.6

Q2 3950 -3.8

Q3 4000 -2.7

Q4 4274 +4.0

AVG = 4110  
(Goal =  $\pm 5\%$ )

TEST ENGINEER

L. Carter 5/17/84 QA

SAIT  
QE4

5/17/84

CUSTOMER (if applicable)

N/A

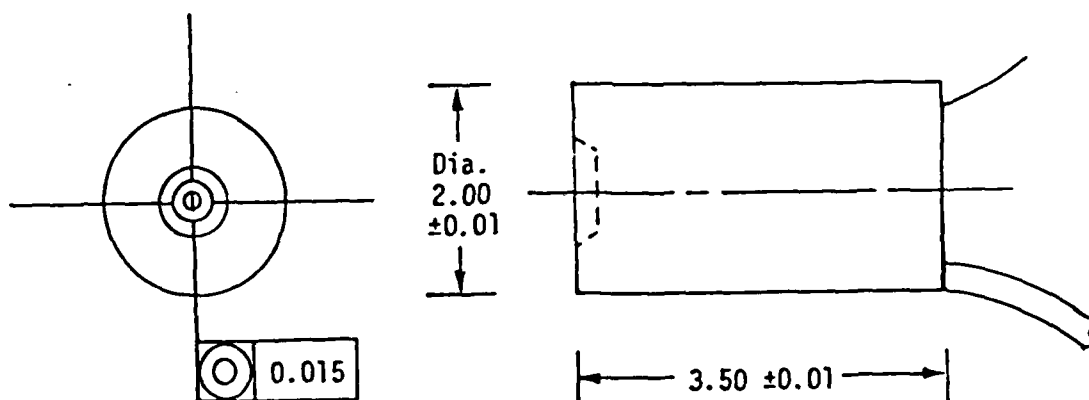
TUBE NO. 673-5 (DVU)

AT 18-4.4  
Initial Release

DATE 5/25/84

PHYSICAL, MECHANICAL DIMENSIONS

- a. Maximum Diameter ( $2.00 \pm 0.01$  inch) 2.01 - 2.00
- b. Maximum Length ( $3.50 \pm 0.01$  inch) 3.49 - 3.51
- c. Concentricity:  
Shield, Anticorona Metalization,  
Cone I.D. Optical Inspection  
(0.015 max. TIR).....Verified OK
- d. Weight (Max. 350 g.).....Verified OK



Inspector E. Russell QA SAIT  
QE4

Customer (if applicable) N/A



SCIENCE APPLICATIONS, INC.  
TECHNOLOGY DEVELOPMENT GROUP (TDG)  
TELEPHONE - SHIPPING/RECEIVING DEPT: (619) 458-3787, 458-3700

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10373 ROSELLE STREET  
SAN DIEGO, CA 92121

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A DIVISION OF SCIENCE APPLICATIONS, INC.  
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SAN DIEGO, CA 92121

TO:

Mr. E.C. Aaron  
Instrumentation Technology  
Engineering, Inc  
10511 Tucker St.  
Beltsville, MD 20705

CONTRACT/PURCHASE ORDER NO.

N00014-82-C-0363

PROJECT NO.

1-131-08-645

DATE DUE

DATE SHIPPED

6-5-84

SHIPPING AUTHORIZATION NO'S.

G. Russell

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REMARKS

ITEM NO	PART NO.	DESCRIPTION	UNIT OF ISSUE	QUANTITY AUTHORIZED	QUANTITY SHIPPED
1	131-18-110-000	Digicon s/n 673-5 (DVU)	ea	1	1

WHITE - PACKING SLIP  
BLUE - REQUESTOR  
GREEN - ACCOUNTING

CANARY - PURCHASING  
PINK - CONTRACTS  
GOLD - SHIPPING

AUTHORIZED SIGNATURE

DATE

X Gary Mulvaney

6-5-84



SERIAL NUMBER 676-5

FIRST FLIGHT TUBE (F-1)

4 June 1984



#106

Office of Naval Research  
Department of the Navy  
459 Summer Street  
Boston, MA 02210

Attention: Dr. Fred Quell

Subject: Certificate of Performance

Reference: Contract N00014-82-C-0363

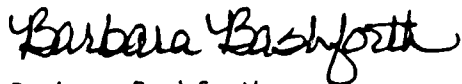
Gentlemen:

Science Applications, Inc. (SAI) provides herewith two (2) copies of the "Certificate of Performance" for the FOS Digicon, SAI Part 131-18-110-000 and Serial Number 676-5 (F#1). This is to certify that the items were tested in accordance with the attached test reports, in accordance with the above referenced contract.

Should you require any additional technical information, please contact Mr. Gary Russell at (619) 458-3796.

Very truly yours,

SCIENCE APPLICATIONS, INC.



Barbara Bashforth  
Administrative Assistant  
Technology Development Group

/bb

Enclosures

cc: Mr. Pete Petiford - DCASMA, San Diego

bcc: J. McCoy  
G. Russell  
Chron  
File  
Deliverables

**Science Applications, Inc.** 10401 Roselle Street, San Diego, California 92121, (619) 458-3700

Other SAI Offices: Albuquerque, Atlanta, Chicago, Dayton, Denver, Huntsville, Los Angeles, Oak Ridge, San Diego, San Francisco, Tucson, and Washington, D.C.

May 30, 1984



SHAD QUAD DIGICON [1-131-08-645]

SAI P/N: 131-18-110-000  
S/N: 676-5 (F#1)

Contract No: N00014-82-C-0363  
Office of Naval Research

CERTIFICATE OF PERFORMANCE

This is to certify that the item noted was tested in accordance with the SAI Acceptance Test Procedures AT-18-4.1— Photocathode Response (QE), AT-18-4.2A— Diode Array Response, AT-18-4.3A— Digicon Performance, and AT-18-4.4— Physical, Mechanical Dimensions (Ref Request for Deviation/Waiver 5/29/84 #W8401). Test Data Summary Sheets are attached for each test. Physical test reports and data on file at this facility and are available for review by ONR.

Gary L. Russell  
Quality Assurance

Distribution: SAI Test  
SAI QA  
SAI Contracts (4)  
SAI File

ENCAPSULATED DIGICON ACCEPTANCE TESTS (SHAD)

DIGICON NO. 676-5 (F-1)

<u>TEST</u>	<u>DATE</u>
4.1 PHOTOCATHODE RESPONSE (QE)	<u>5/23/84</u>
4.2 DIODE ARRAY RESPONSE	
a. Leakage	<u>5/29/84</u>
b. Capacitance	<u>5/29/84</u>
c. $\Delta E/E$	<u>5/29/84</u>
4.3 DIGICON PERFORMANCE	
a. Magnification	<u>5/24/84</u>
b. Error Function	<u>5/24/84</u>
c. Dark Count	<u>5/24/84</u>
d. Uniformity	<u>5/24/84</u>
4.4 PHYSICAL	
a. Diameter	<u>5/29/84</u>
b. Length	<u>5/29/84</u>
c. Centering	<u>5/29/84</u> <span style="border: 1px solid black; padding: 2px;">SAI 25</span>
d. Weight	<u>5/29/84</u>

Data Distribution:

- ☐ Test Build Log Book
- ☐ Test Lab
- ☐ Tube Engineer
- ☐ Quality Assurance
- ☐ Customer
- ☐ File

TUBE NO. 676-5 (SHAD F-1)  
 DATE 5/23/85

PHOTOCATHODE RESPONSE  
Visible Current Mode Quantum Efficiency Data Sheet

Wave- Length (nm)	Tube Signal (A)	Calibration Standard Signal (A)	Standard Calibration (QE%)	Comments	Calculated QE (%)	Goal QE (%)
	E	E				
360	.102 18	.767 19	19.3	BLUE FILTER IN	25.7	
400	.130 17	.804 18	15.4		24.9	25.0
460	.273 17	.162 17	10.5		17.7	
500	.456 17	.282 17	7.96	BLUE FILTER OUT	12.9	15.0
560	.462 17	.286 17	5.09		8.22	
600	.395 17	.260 17	3.86	YELLOW FILTER IN	5.86	
660	.255 17	.172 17	2.52		3.74	
700	.190 17	.119 17	1.72		2.75	2.5
760	.980 18	.425 18	.726		1.67	
800	.480 18	.119 18	.245		.988	0.1

Test Engineer L. Acton 5-23-84 QA

Customer (if applicable) Wibron



5/23/84

Calculated QE% =  $\frac{\text{Tube Signal}}{\text{Calibration Standard Signal}} \times \text{Standard Calibration QA\%}$

TUBE NO. 676-5 (SHAD F-1)

DATE 5-24-84

4.3.a

DIGICON PERFORMANCE

a. MAGNIFICATION

DIODE A

	1/2	CENTER	1/2
$\mu$ Divisions	<u>4</u>	<u>2</u>	<u>18</u>
Count Rate	<u>2250</u>	<u>4562</u>	<u>2324</u>
S (Total No. Divisions)	<u><math>50 \cdot 4 + 18 = 64</math></u>		
W = S * ( $\mu$ /Divisions)	<u><math>64 * 10 = 640</math></u>		
M (Magnification) = D/W (D = Diode Width)	<u><math>400 \mu\text{m} / 640 = .63</math></u>		

DIODE 3

	1/2	CENTER	1/2
$\mu$ Divisions	<u>19</u>	<u>36</u>	<u>28</u>
Count Rate	<u>2340</u>	<u>4669</u>	<u>2370</u>
S (Total No. Divisions)	<u><math>19 + 50 + 28 = 59</math></u>		
W = S * ( $\mu$ /Divisions)	<u><math>59 * 10 = 590</math></u>		
M (Magnification) = D/W (D = Diode Width)	<u><math>400 \mu\text{m} / 590 = .68</math></u>		

(Average Magnification  $\left(\frac{M_1 + M_2}{2}\right) =$  .66 Goal =  $0.6 < M < 1$ )

TEST ENGINEER

E. Ngim

CUSTOMER (if applicable)

[Signature]



5/24/84



5/25/84

Wilmer

Figure 4.3a

18-4.3  
ge 5

3.c,d

TUBE NO. 674-5 F-3  
DATE 11-29-84

DIGICON PERFORMANCE

100 SECOND INTEGRATION DARK COUNT

Q1 = 249  
Q2 = 236  
Q3 = 268  
Q4 = 256  
TOTAL = 1003

C = TOTAL/400 = 2.5  
(Goal = 10)

d. QUADRANT RESPONSE UNIFORMITY

	% AVG
Q1 <u>5866</u>	<u>+0.43%</u>
Q2 <u>5747</u>	<u>-1.64%</u>
Q3 <u>5858</u>	<u>+0.29%</u>
Q4 <u>5895</u>	<u>+0.92%</u>

AVG = 5841  
(Goal =  $\pm 5\%$ )

TEST ENGINEER

E. Unger / J. Peterson QA



CUSTOMER (if applicable) \_\_\_\_\_

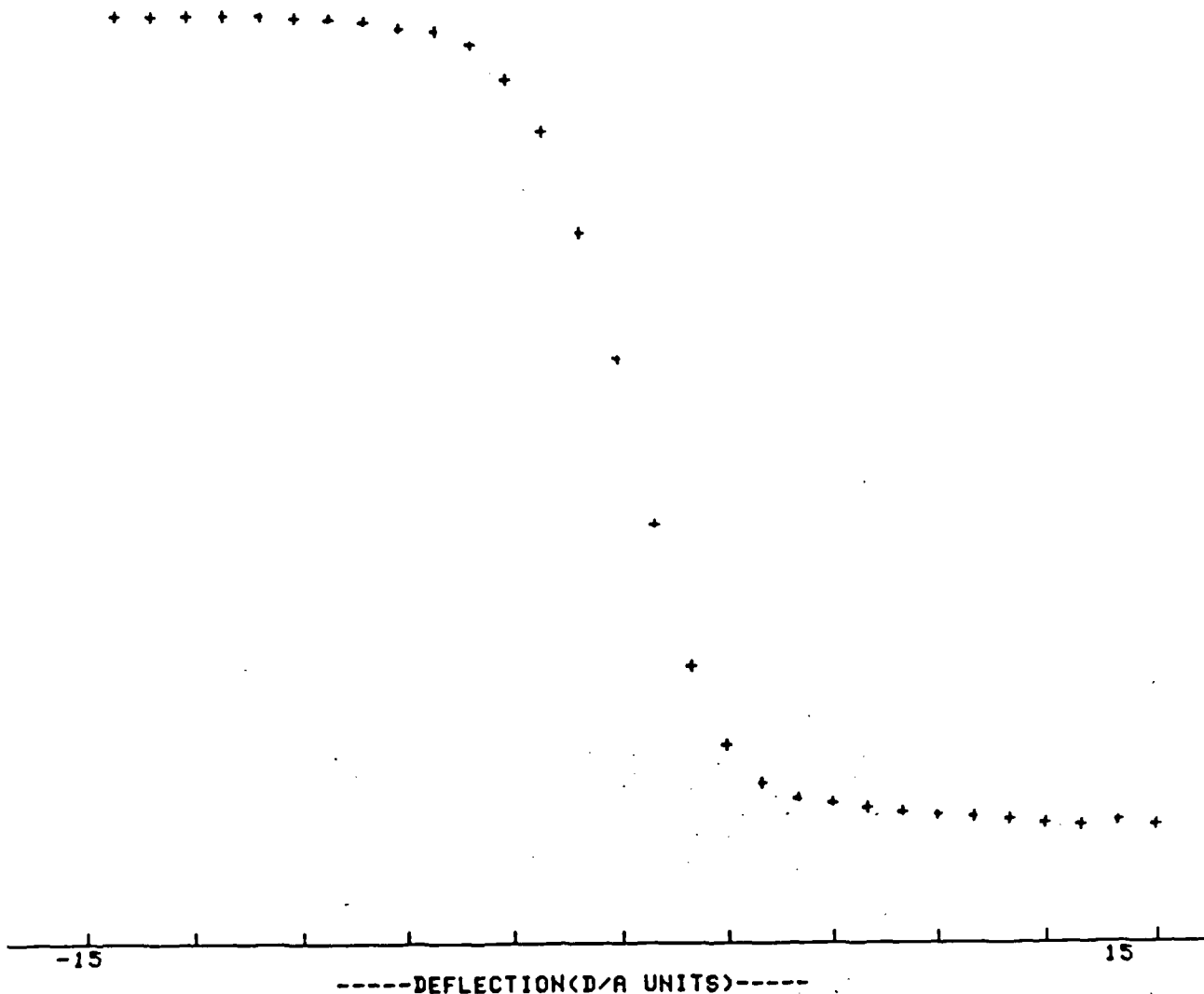
Figure 4.3b

5 / 24 / 83 13 : 48 ( 55 Sec.)  
D TUBE SCAN

5 / 24 / 83 13 : 55 ( 17 Sec.)  
D TUBE SCAN

US  
SWEEP @ Y = 0  
M -15 TO 15 IN 31 STEPS OF 1 EACH 1 Sec

AMP No. 1 COUNTER No. 18 DIODE No. 1 THRESHOLD = 84  
LE MAX, SCALE MIN = 20000 0



m1, Hfm2, FWHM, Pos. = -14.44 27 14.8 -7.03  
%-90%, 90%-10%, AVE = .7 (5.69) 3.19  
X COUNT, MIN COUNT = 21830.5 2774.54

SAIT  
QE4

TD. DEV OF EFUN = .875349316025  
5 / 24 / 83 13 : 57 ( 27 Sec.)  
\*\*\*QUAD08(7/24/83)\*\*\*



18-4.2  
e 7

TUBE NO. 676-5 (F-1)  
DATE 5/29/84

QUAD DIGICON ARRAY RESPONSE

DIODE	PIN	LEAKAGE CURRENT (nA) Goal $\leq 1$ nA	CAPACITANCE (pf) Goal $\leq 15$ pf	$\Delta E/E$ Goal $\leq 0.25$
Q1	2	0.9	12.2	0.25
Q2	5	1.3	11.7	0.34
Q3	9	1.1	11.4	0.33
Q4	12	1.3	12.0	0.33
G1	1	1.5	8.6	0.30
G2	3	1.1	9.1	0.35
G3	4	0.9	9.0	0.31
G4	6	1.2	9.0	0.31
G5	8	0.7	8.8	0.32
G6	10	0.5	8.6	0.38
G7	11	1.0	9.2	0.42
G8	13	0.7	9.4	



5/29/84

Witnessed by [Signature]  
Sens QAR  
5/5/84



5/29/84

NO. 676-5 (F-1)  
5/29/84

AT 18-4.4  
Initial Release

PHYSICAL, MECHANICAL DIMENSIONS

a. Maximum Diameter ( $2.00 \pm 0.01$  inch) verified

b. Maximum Length ( $3.50 \pm 0.01$  inch) verified

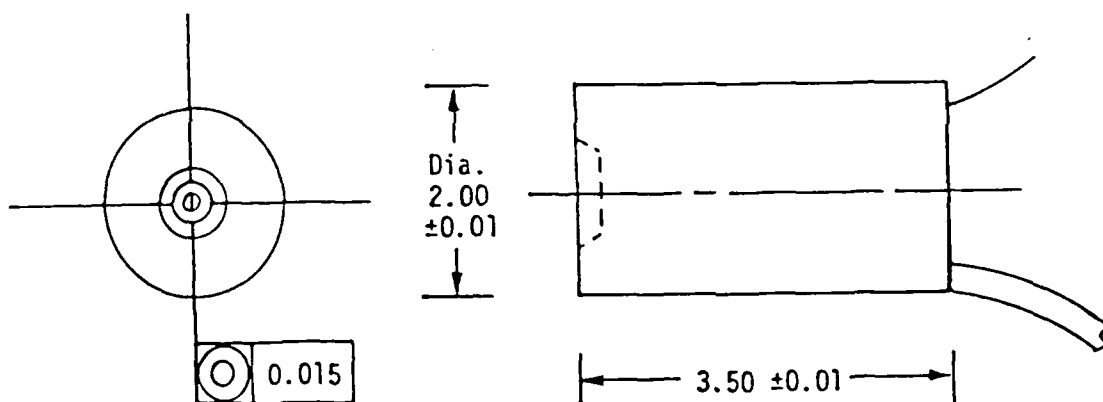
c. Concentricity:

Shield, Anticorona Metalization,  
Cone I.D. Optical Inspection  
(0.015 max. TIR).....Verified

~.020 OUT OF SPEC.

SAI  
25

d. Weight (Max. 350 g.).....Verified 340g approx



Inspector

E. Russell

QA

SAI  
064

Customer (if applicable)

see request for Deviation/waiver 5/29/84  
#WB401

TUBE NO. 691-5  
 DATE 10.4.84

### DIGICON PERFORMANCE

#### MAGNIFICATION

DIODE 2

	1/2	CENTER	1/2
$\mu$ Divisions	<u>637</u>	<u>—</u>	<u>584</u>
Count Rate	<u>2734</u>	<u>5800</u>	<u>2683</u>
S (Total No. Divisions)	<u>637 - 584 = 53</u>		
W = S * ( $\mu$ /Divisions)	<u>53 * 10 = 530</u>		
M (Magnification) = D/W (D = Diode Width)	<u>400 / 530 = .75</u>		

DIODE 4

	1/2	CENTER	1/2
$\mu$ Divisions	<u>584</u>	<u>—</u>	<u>527</u>
Count Rate	<u>2760</u>	<u>5480</u>	<u>2714</u>
S (Total No. Divisions)	<u>584 - 527 = 57</u>		
W = S * ( $\mu$ /Divisions)	<u>57 * 10 = 570</u>		
M (Magnification) = D/W (D = Diode Width)	<u>400 / 570 = .70</u>		

(Average Magnification  $\left(\frac{M_1 + M_2}{2}\right) = \left(\frac{1.45}{2}\right) = .725$  Goal =  $0.6 < M < 1$ )

TEST ENGINEER E. Nizim QA SAIT QEB 10/5/84

CUSTOMER (if applicable) \_\_\_\_\_

Figure 4.3a

10-4.3  
e 4

TUBE NO. 691-5  
DATE 10-4-84

a

DIGICON PERFORMANCE

a. MAGNIFICATION

DIODE 1

	1/2	CENTER	1/2
$\mu$ Divisions	<u>536</u>	<u>—</u>	<u>586</u>
Count Rate	<u>2794</u>	<u>5356</u>	<u>2747</u>
S (Total No. Divisions)	<u>586 - 536 = 50</u>		
W = S * ( $\mu$ /Divisions)	<u>50 * 10 = 500</u>		
M (Magnification) = D/W (D = Diode Width)	<u>400 / 500 = .80</u>		

DIODE 3

	1/2	CENTER	1/2
$\mu$ Divisions	<u>598</u>	<u>—</u>	<u>648</u>
Count Rate	<u>1912</u>	<u>4222</u>	<u>2082</u>
S (Total No. Divisions)	<u>648 - 598 = 50</u>		
W = S * ( $\mu$ /Divisions)	<u>50 * 10 = 500</u>		
M (Magnification) = D/W (D = Diode Width)	<u>400 / 500 = .80</u>		

(Average Magnification  $\left(\frac{M_1 + M_2}{2}\right) = \left(\frac{.60 + .80}{2}\right) = .70$  Goal =  $0.6 < M < 1$ )

TEST ENGINEER E. J. J. J. QA SAIT OER 10/5/84

CUSTOMER (if applicable) \_\_\_\_\_

Figure 4.3a

TUBE NO. 691-5 (SHAD 1-8)  
DATE 10-5-84

QUAD DIGICON ARRAY RESPONSE

DIODE	PIN	LEAKAGE CURRENT (nA) Goal $\leq 1$ nA	CAPACITANCE (pf) Goal $\leq 15$ pf	$\Delta E/E$ Goal $\leq 0.25$
Q1	2	.58	<del>7.8</del> 10.0	.29
Q2	5	.63	10.5	.28
Q3	9	.86	10.7	.28
Q4	12	.54	9.7	.28
G1	1	.83	7.8	.26
G2	3	.45	8.5	.25
G3	4	.48	7.4	.25
G4	6	.59	7.7	.25
G5	8	.91	7.2	.25
G6	10	.58	8.7	.25
G7	11	.55	7.4	.25
G8	13	.46	9.5	.25

EJg 10-5-84



10/5/84

AT 18-4.1

TUBE NO. 691-5 (SMD F-8)DATE 10-4-84

## PHOTOCATHODE RESPONSE

Visible Current Mode Quantum Efficiency Data Sheet

Wave-length (nm)	Tube Signal (A)	Calibration Standard Signal (A)	Standard Calibration (QE%)	Comments	Calculated QE (%)	Goal QE (%)
360	.142 <sup>19</sup>	.166 <sup>19</sup>	19.3		16.5	
400	.232 <sup>18</sup>	.192 <sup>18</sup>	15.4		18.6	25.0
460	.725 <sup>18</sup>	.461 <sup>18</sup>	10.5		16.5	
500	1.42 <sup>18</sup>	.842 <sup>18</sup>	7.96		13.4	15.0
560	1.75 <sup>18</sup>	.933 <sup>18</sup>	5.09		9.55	
600	1.55 <sup>18</sup>	.785 <sup>18</sup>	3.86		7.62	
660	1.33 <sup>18</sup>	.631 <sup>18</sup>	2.52		5.31	
700	1.06 <sup>18</sup>	.445 <sup>18</sup>	1.72		4.10	2.5
760	.593 <sup>18</sup>	.159 <sup>18</sup>	.726		2.71	
800	3.50 <sup>19</sup>	.436 <sup>19</sup>	.245		1.97	0.1

Test Engineer

E. Jozin

QA

10/5/84

Customer (if applicable) \_\_\_\_\_

Calculated QE% =  $\frac{\text{Tube Signal}}{\text{Calibration Standard Signal}} \times \text{Standard Calibration QA\%}$



SCIENCE APPLICATIONS, INC.  
APPLIED SCIENCE & TECHNOLOGY GROUP  
TELEPHONE - SHIPPING/RECEIVING DEPT.: (714) 452-9150

**SHIPPER CONTROL**

NO. 10455

Systems Division  
ELECTRONIC VISION COMPANY  
1526 SORRENTO VALLEY ROAD, SUITE A  
SAN DIEGO, CA. 92121

TO: Instrumentation Technology Engineering, Inc.  
10511 Tucker Street  
Beltsville, MD 20705  
Attn: Mr. E. C. Aaron

INSTRUMENTATION DEVELOPMENT LAB  
1526 SORRENTO VALLEY ROAD, SUITE B  
SAN DIEGO, CA. 92121

EFFLUENT CONTROL LAB  
1030 SORRENTO VALLEY BLVD.  
SAN DIEGO, CA. 92121

SAI TECHNOLOGY COMPANY  
1060 SORRENTO VALLEY BLVD.  
SAN DIEGO, CA. 92121

INVOICE/PURCHASE ORDER NO. 0014-82-C-0363	PROJECT NO. 1-131-08-645-00	DATE DUE 10/8/84	DATE SHIPPED 10/4/84
SHIPPING AUTHORIZATION NO'S.	SHIPMENT <input checked="" type="checkbox"/> PARTIAL <input type="checkbox"/> FINAL <input type="checkbox"/> COMPLETE	NET WEIGHT	GROSS WEIGHT
PACKED VIA	CARRIER Federal Express	FOB Destination	CUBE
MARKS			NO. PACKAGES 1
			<input checked="" type="checkbox"/> PREPAID <input type="checkbox"/> COLLECT

PART NO.	DESCRIPTION	UNIT OF MEASURE	QUANTITY AUTHORIZED	QUANTITY SHIPPED
	SHAD Flight Digicon #2, S/N 691-5	each	1	1
	Line Item 0001AE			
	Copy of Test Data	each	1	1
<p>ok to ship: D.G. Wood</p> <p>W. W. Huffman</p> <p>SAIT QEB</p> <p>DCAS 10/5/84</p>				

AUTHORIZED SIGNATURE

X

DATE

10/4/84

PACKING SLIP

ENCAPSULATED DIGICON ACCEPTANCE TESTS (SHAD)

DIGICON NO. 691-5

<u>TEST</u>	<u>DATE</u>
4.1 PHOTOCATHODE RESPONSE (QE)	<u>10-4-84</u>
4.2 DIODE ARRAY RESPONSE	
a. Leakage	<u>10-5-84</u>
b. Capacitance	<u>10-5-84</u>
c. $\Delta E/E$	<u>10-5-84</u>
4.3 DIGICON PERFORMANCE	
a. Magnification	<u>10-4-84</u>
b. Error Function	<u>10-4-84</u>
c. Dark Count	<u>10-4-84</u>
d. Uniformity	<u>10-5-84</u>
4.4 PHYSICAL	
a. Diameter	<u>10-5-84</u>
b. Length	<u>10-5-84</u>
c. Centering	<u>10-5-84</u>
d. Weight	<u>10-5-84</u>

Data Distribution:

- ☐ Test Build Log Book
- ☐ Test Lab
- ☐ Tube Engineer
- ☐ Quality Assurance
- ☐ Customer
- ☐ File





Science Applications International Corporation

December 3, 1984

SHAD QUAD DIGICON (1-131-08-645)

SAIC P/N: 131-18-110-000

SAIC S/N: 691-5 (F#2)

Contract No.: N00014-82-C-0363  
Office of Naval Research

CERTIFICATE OF PERFORMANCE

This is to certify that the item noted was tested in accordance with the SAIC Acceptance Test Procedures AT-18-4.1- Photocathode Response (QE), AT-18-4.2A- Diode Array Response, AT-18-4.3A- Digicon Performance, and AT-18-4.4- Physical, Mechanical Dimensions. Test Data Summary Sheets are attached for each test. Physical test reports and data are on file at this facility and are available for review by ONR.

A handwritten signature in cursive script, reading "Gary L. Russell". The signature is written in black ink and is positioned above a horizontal line.

Gary L. Russell  
Quality Assurance

Distribution: SAIC Test  
SAIC QA  
SAIC Contracts (4)  
SAIC File



Science Applications International Corporation

#216

3 December 1984

Office of Naval Research  
Department of the Navy  
459 Summer Street  
Boston, MA 02210

Attention: Dr. Fred Quell

Subject: Certificate of Performance

Reference: Contract N00014-82-C-0363

Gentlemen:

Science Applications International Corporation (SAIC) provides herewith two (2) copies of the "Certificate of Performance" for the FOS Digicon, SAI Part Number 131-18-110-000 and Serial Number 691-5 (F#2). This is to certify that the items were tested in accordance with the attached test reports, in accordance with the above referenced contract.

Should you require any additional technical information, please contact Mr. Gary Russell at (619) 458-3796.

Very truly yours,

SCIENCE APPLICATIONS INTERNATIONAL CORP.

A handwritten signature in black ink that reads "Barbara Bashforth". The signature is written in a cursive, flowing style.

Barbara Bashforth  
Administrative Assistant

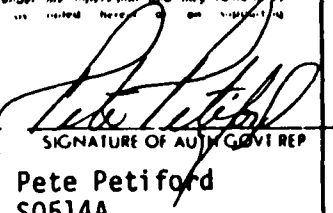
/bb

Enclosures

cc: Mr. Pete Petiford - DCASMA (San Diego)

SERIAL NUMBER 691-5

SECOND FLIGHT TUBE (F-2)

<b>MATERIAL INSPECTION AND RECEIVING REPORT</b>		1 PROC INSTRUMENT IDEN (CONTRACT) N00014-82-C-0363		ORDER NO	6 INVOICE NO. DATE	7 PAGE OF 1	8 ACCEPTANCE POINT D
2 SHIPMENT NO SAI0001	3 DATE SHIPPED 84JUN07	4 B/L ICN		5 DISCOUNT TERMS 2.			
9 PRIME CONTRACTOR Science Applications, Inc. 10401 Roselle Street San Diego, CA 92121		CODE 52302	10 ADMINISTERED BY DCASMA - La Jolla Bldg. 4, AF Plant 19 4297 Pacific Highway San Diego, CA 92110		CODE S0514A		
11 SHIPPED FROM (if other than 9) CODE Same as Block 9		52302	FOB S	12 PAYMENT WILL BE MADE BY DCASMA - Los Angeles 11099 So. La Cienega Blvd. P.O. Box 45011 Los Angeles, CA 90045		CODE S0506A	
13 SHIPPED TO Instrumentation Technology Engineering, Inc. 10511 Tucker Street Beltsville, MD 20705		CODE	14 MARKED FOR Mr. E. C. Aaron		CODE		
15 ITEM NO	16 STOCK PART NO (Indicate number of shipping containers type of container container number)	DESCRIPTION		17 QUANTITY SHIP'D, REC'D	18 UNIT	19 UNIT PRICE	20 AMOUNT
0001 AD		The Contractor shall design, build, test and deliver one space-qualified flight model of their intensified quadrant photomultiplier tube.  SAI Part No. 131-18-100-000 Serial No. 676-5 (F-1) (18 mm Quadrant Digicon Guider Tube Assembly)		1	EA	NSP	NSP
21 PROCUREMENT QUALITY ASSURANCE				22 RECEIVER'S USE			
<input checked="" type="checkbox"/> <b>PQA</b> <input type="checkbox"/> <b>A ORIGIN</b> ACCEPTANCE of listed items has been made by me or under my supervision and they conform to contract except as noted herein or on supporting documents.		<input type="checkbox"/> <b>PQA</b> <input checked="" type="checkbox"/> <b>B DESTINATION</b> ACCEPTANCE of listed items has been made by me or under my supervision and they conform to contract except as noted herein or on supporting documents.		Quantities shown in column 17 were received in apparent good condition except as noted.			
DATE 84 JUN 07		SIGNATURE OF AUTH GOVT REP 		DATE 		SIGNATURE OF AUTH GOVT REP 	
TYPED NAME AND OFFICE Pete Petiford S0514A		TYPED NAME AND TITLE 		DATE RECEIVED 			
TYPED NAME AND OFFICE S0514A		TYPED NAME AND TITLE 		*If quantity received by the Government is the same as quantity shipped, indicate by ( ' ) mark, if different, enter actual quantity received below quantity shipped and encircle.			
23 CONTRACTOR USE ONLY							

<b>MATERIAL INSPECTION AND RECEIVING REPORT</b>		1 PROC INSTRUMENT IDEN (CONTRACT) N00014-82-C-0363		ORDER NO	6 INVOICE NO. DATE	7 PAGE 1 OF 1	8. ACCEPTANCE POINT D
		2 SHIPMENT NO SAI0001		3 DATE SHIPPED 84JUN07		4 B/L TCN	
9 PRIME CONTRACTOR Science Applications, Inc. 10401 Roselle Street San Diego, CA 92121		CODE 52302		10 ADMINISTERED BY DCASMA - La Jolla Bldg. 4, AF Plant 19 4297 Pacific Highway San Diego, CA 92110		CODE S0514A	
11 SHIPPED FROM (If other than 9) CODE Same as Block 9		52302 FOB S		12 PAYMENT WILL BE MADE BY DCASMA - Los Angeles 11099 So. La Cienega Blvd. P.O. Box 45011 Los Angeles, CA 90045		CODE S0506A	
13 SHIPPED TO Instrumentation Technology Engineering, Inc. 10511 Tucker Street Beltsville, MD 20705		CODE		14 MARKED FOR Mr. E. C. Aaron		CODE	
15 ITEM NO	16 STOCK PART NO (Indicate number of shipping containers-type of container container number.)	DESCRIPTION		17 QUANTITY SHIP'D/REC'D	18 UNIT	19 UNIT PRICE	20 AMOUNT
0001 AD		The Contractor shall design, build, test and deliver one space-qualified flight model of their intensified quadrant photomultiplier tube.  SAI Part No. 131-18-100-000 Serial No. 676-5 (F-1) (18 mm Quadrant Digicon Guider Tube Assembly)		1	EA	NSP	NSP
21 PROCUREMENT QUALITY ASSURANCE				22 RECEIVER'S USE			
<input checked="" type="checkbox"/> PQA <input type="checkbox"/> A ORIGIN ACCEPTANCE of listed items has been made by me or under my supervision and they conform to contract except as noted herein or on supporting documents.		<input type="checkbox"/> PQA <input checked="" type="checkbox"/> B DESTINATION ACCEPTANCE of listed items has been made by me or under my supervision and they conform to contract except as noted herein or on supporting documents.		Quantities shown in column 17 were received in apparent good condition except as noted.			
DATE 84 JUN 07 SIGNATURE OF AUTH GOVT REP <i>Pete Petiford</i> TYPED NAME AND OFFICE Pete Petiford S0514A		DATE SIGNATURE OF AUTH GOVT REP TYPED NAME AND TITLE		DATE RECEIVED SIGNATURE OF AUTH GOVT REP TYPED NAME AND OFFICE *If quantity received by the Government is the same as quantity shipped, indicate by (s) mark, if different, enter actual quantity received below quantity shipped and encircle.			
23 CONTRACTOR USE ONLY							

7 June 1984



#107

Instrumentation Technology  
Engineering, Inc.  
10511 Tucker Street  
Beltsville, MD 20705

Attention: Mr. E. C. Aaron

Subject: Material Inspection & Receiving Report -  
Shipment of Photomultiplier Tube

Reference: Contract N00014-82-C-0363

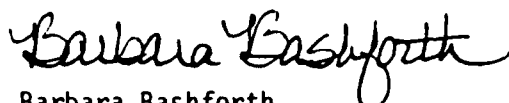
Gentlemen:

In accordance with the requirements of the above referenced contract, Science Applications, Inc. (SAI) provides herewith four (4) copies of the DD Form 250, Material Inspection and Receiving Report completed to verify Shipment No. SAI0001, entitled "Quadrant Photomultiplier Tube" under Contract Line Item Number 0001AD. SAI has been directed by the ONR Technical Representative, Dr. Quell, to ship directly to your facility the enclosed tube.

If you have any questions of a technical nature, contact Mr. John McCoy at (619) 458-3794 or Mr. Gary Russell at (619) 458-3796.

Very truly yours,

SCIENCE APPLICATIONS, INC.



Barbara Bashforth  
Administrative Assistant

/bb

Enclosures

cc: Dr. Fred Quell - ONR  
Mr. Pete Petiford - DCASMA, QAR  
Mr. John Christensen - ONR (CO)

bcc: J. McCoy  
G. Russell  
Chron  
File  
Deliverables

**Science Applications, Inc.** 10401 Roselle Street, San Diego, California 92121, (619) 458-3700

Other SAI Offices: Albuquerque, Atlanta, Chicago, Dayton, Denver, Huntsville, Los Angeles, Oak Ridge, San Diego, San Francisco, Tucson, and Washington, D.C.



DEPARTMENT OF THE NAVY  
OFFICE OF NAVAL RESEARCH  
DETACHMENT, BOSTON  
495 SUMMER STREET  
BOSTON, MA 02210

IN REPLY REFER TO

FWQ:ac1  
31 May 1984

SAI  
Attn: Gerry Russel  
Quality Assurance  
10401 Roselle Street  
San Diego, CA 92121

Dear Mr. Russel:

By authority of this letter you are advised to ship the SHAD flight  
F1 Quadrant Tube #676-5 with open waver #W8401.

Sincerely yours,

  
FRED W. QUELLE

REQUEST FOR DEVIATION/WAIVER  
(SEE MIL-STD-480 OH 481 FOR INSTRUCTIONS)

DATE PREPARED

5/29/84

PROCURING ACTIVITY NO.

1. ORIGINATOR NAME AND ADDRESS

Science Applications, Inc. Electronic Vision Systems  
11526 Sorrento Valley Rd. San Diego, CA 92121 Division

2. ☐ DEVIATION ☒ WAIVER

3. ☐ MINOR ☐ MAJOR ☐ CRITICAL

4. DESIGNATION FOR DEVIATION/WAIVER

a. MODEL/TYPE b. MFR. CODE c. SYS. DESIG. d. DEV/WAIVER NO  
IBMm Digicon 60717 WBA01

5. BASE LINE AFFECTED

☐ FUNCTIONAL ☐ ALLOCATED ☒ PRODUCTION

6. OTHER SYSTEMS/CONFIGURATION ITEMS AFFECTED

☐ YES ☒ NO

7. SPECIFICATIONS AFFECTED-TEST PLAN

	MFR. CODE	SPEC./DOC. NO.	SCN
a. SYSTEM			
b. ITEM			
c. TEST PLAN			

8. DRAWINGS AFFECTED

MFR. CODE	NUMBER	REV.	NOR. NO.
60717	131-18-11000	C	

9. TITLE OF DEVIATION/WAIVER

Mechanical Dimension - Concentricity

10. CONTRACT NO. & LINE ITEM

N00014-B2-C-0363  
Item 0001

11. CONFIGURATION ITEM NOMENCLATURE

15. NAME OF PART OR LOWEST ASSEMBLY AFFECTED

Guider Tube Assy

16. PART NO. OR TYPE DESIG.

131-18-110-000

12. CD NO.

13. DEFECT NO.

CLASSIFICATION OF DEFECT

14. DEFECT CLASSIFICATION

☒ MINOR ☐ MAJOR ☐ CRITICAL

17. LGT NO.

18. QTY

19. RECURRING DEVIATION/WAIVER

☐ YES ☒ NO

20. EFFECT ON COST/PRICE

None

21. EFFECT ON DELIVERY SCHEDULE

None

22. EFFECT ON INTEGRATED LOGISTIC SUPPORT, INTERFACE, ETC.

TBD

23. DESCRIPTION OF DEVIATION/WAIVER

Guider tube concentricity in potted configuration - drawing specifies .015 TIR tube assembly measures  $\approx$  .02 TIR, on Assembly # 676-5.

(Note: Corrective Action has been instituted to preclude recurrence of this nonconformance. The potting fixture was modified and additional inspection points incorporated.)

24. NEED FOR DEVIATION/WAIVER

25. PRODUCTION EFFECTIVITY BY SERIAL NUMBER

SIN 676-5 (SHAD F#1)

26. SUBMITTING ACTIVITY AUTHORIZING SIGNATURE

Sam J. Russell

TITLE

QUALITY ASSURANCE

27. APPROVAL/DISAPPROVAL

☐ APPROVAL RECOMMENDED

☐ APPROVED

☐ DISAPPROVED

c. GOVERNMENT ACTIVITY

SIGNATURE

DATE

DD FORM 1694

U. S. GOVERNMENT PRINTING OFFICE: 1968 O - 332-003

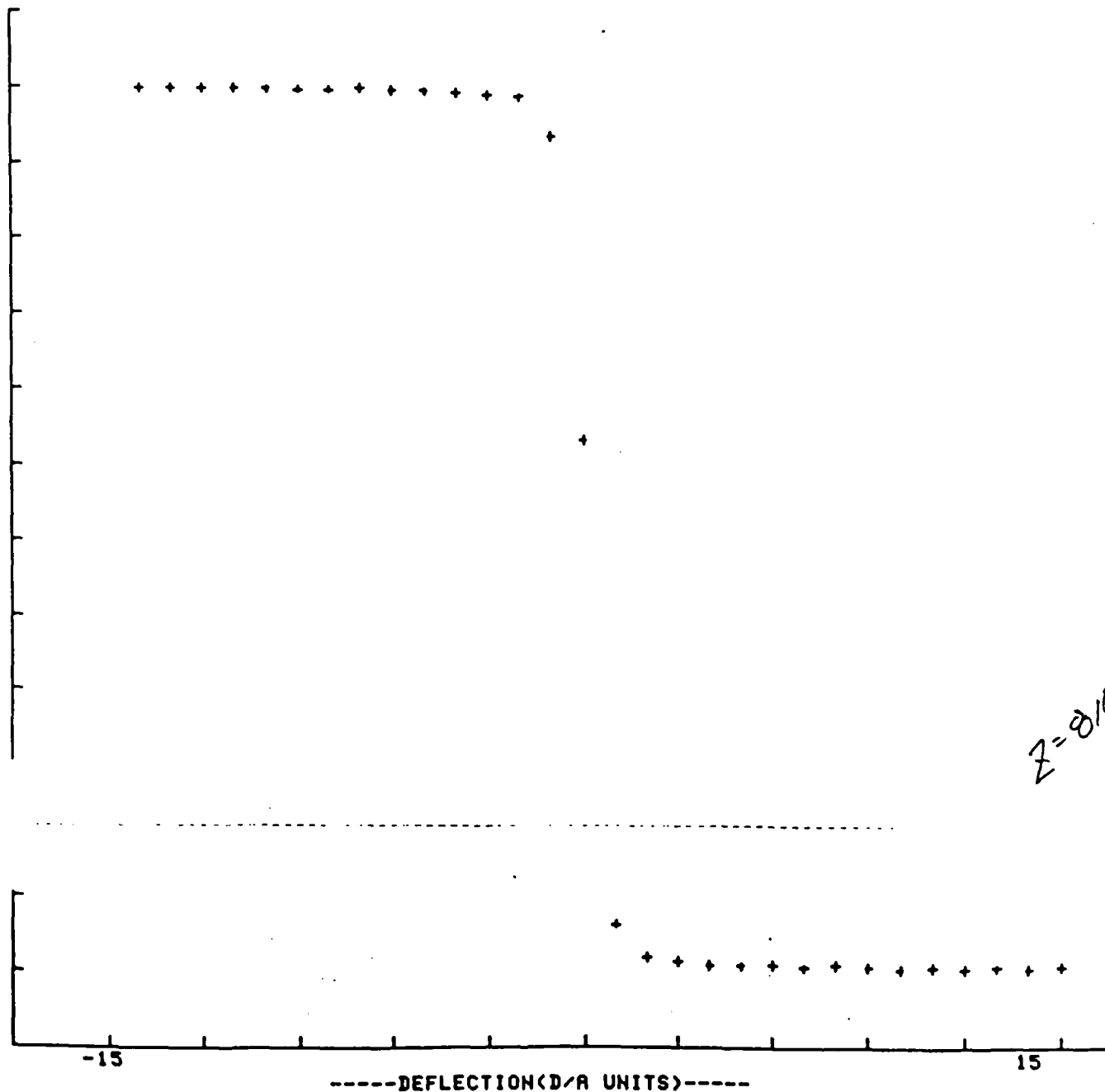


10 / 4 / 83 14 : 15 ( 33 Sec.)  
QUAD TUBE SHAD F-8 ATP 10-4-84

10 / 4 / 83 14 : 22 ( 31 Sec.)  
QUAD TUBE SHAD F-8 ATP 10-4-84

X-SWEEP @ Y = 0  
FROM -15 TO 15 IN 31 STEPS OF 1 EACH 1 Sec

PREAMP No. 1 COUNTER No. 18 DIODE No. 1 THRESHOLD = 60  
SCALE MAX, SCALE MIN = 20000 0



Hfm1, Hfm2, FWHM, Pos. = -14.45 .07 14.52 -7.19  
10%-90%, 90%-10%, AVE = .72 1.82 1.27  
MAX COUNT, MIN COUNT = 21932.8 2073.94

RESOLUTION  
(ERROR FUNCTION)

SAIT  
QEB

10/5/84

E1/qi 10-4-84

STD. DEV OF EFUN = .979056511223

4.3.c,d

TUBE NO. 691-5 (SHAD F-8)

DATE 10-5-84

DIGICON PERFORMANCE

c. 100 SECOND INTEGRATION DARK COUNT

Q1 = 567  
Q2 = 573  
Q3 = 426  
Q4 = 564  
TOTAL = 2130

C = TOTAL/400 = 5.325  
(Goal = 10)

d. QUADRANT RESPONSE UNIFORMITY

	% AVG
Q1 <u>4263</u>	<u>-0.95</u>
Q2 <u>4784</u>	<u>+1.03</u>
Q3 <u>4628</u>	<u>+1.02</u>
Q4 <u>4354</u>	<u>-0.97</u>

4507 =  $\bar{x}$

AVG = ~~4507~~ 0.99%  
(Goal =  $\pm 5\%$ )

TEST ENGINEER

E. Virgin

QA



10/5/84

CUSTOMER (if applicable) \_\_\_\_\_

Figure 4.3b

TUBE NO. 691-5

DATE 10-5-84

AT 18-4.4  
Initial Release

PHYSICAL, MECHANICAL DIMENSIONS

a. Maximum Diameter ( $2.00 \pm 0.01$  inch) 2.001

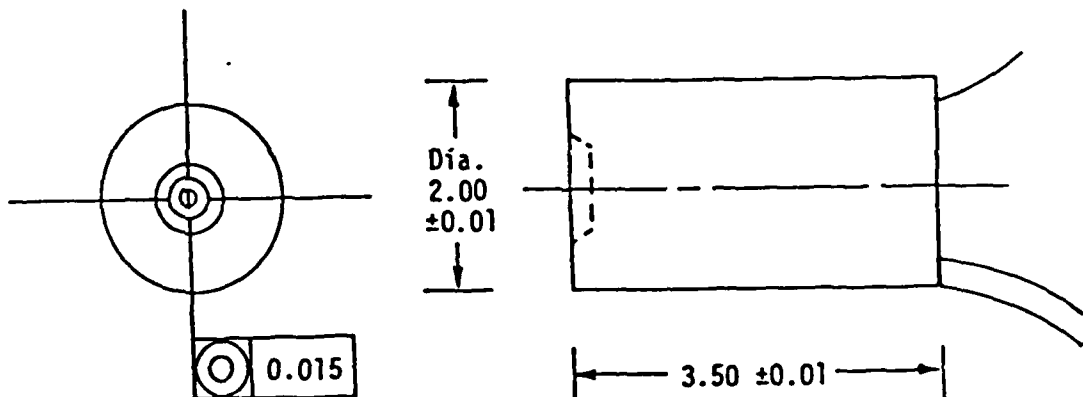
b. Maximum Length ( $3.50 \pm 0.01$  inch) 3.499

c. Concentricity:

Shield, Anticorona Metalization,  
Cone I.D. Optical Inspection

(0.015 max. TIR).....Verified 0.012 in

d. Weight (Max. 350 g.).....Verified 317 grams



Inspector E. Vign 10-5-84 QA SAIT QE8 10/5/84  
Customer (if applicable) \_\_\_\_\_

SERIAL NUMBER 674-5

THIRD FLIGHT TUBE (F-3)

*Gary Russell*



Science Applications International Corporation  
#215

3 December 1984

Office of Naval Research  
Department of the Navy  
459 Summer Street  
Boston, MA 02210

Attention: Dr. Fred Quell

Subject: Certificate of Performance

Reference: Contract N00014-82-C-0363

Gentlemen:

Science Applications International Corporation (SAIC) provides herewith two (2) copies of the "Certificate of Performance" for the FOS Digicon, SAI Part Number 131-18-110-000 and Serial Number 674-5 (F#3). This is to certify that the items were tested in accordance with the attached test reports, in accordance with the above referenced contract.

Should you require any additional technical information, please contact Mr. Gary Russell at (619) 458-3796.

Very truly yours,

SCIENCE APPLICATIONS INTERNATIONAL CORP.

*Barbara Bashforth*

Barbara Bashforth  
Administrative Assistant

/bb

Enclosures

cc: Mr. Pete Petiford - DCASMA (San Diego)



Science Applications International Corporation

December 3, 1984

SHAD QUAD DIGICON (1-131-08-645)

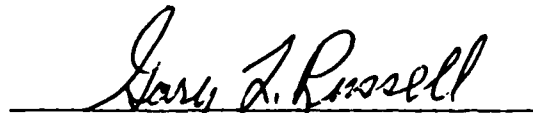
SAIC P/N: 131-18-110-000

SAIC S/N: 674-5 (F#3)

Contract No.: N00014-82-C-0363  
Office of Naval Research

CERTIFICATE OF PERFORMANCE

This is to certify that the item noted was tested in accordance with the SAIC Acceptance Test Procedures AT-18-4.1- Photocathode Response (QE), AT-18-4.2A- Diode Array Response, AT-18-4.3A- Digicon Performance, and AT-18-4.4- Physical, Mechanical Dimensions. Test Data Summary Sheets are attached for each test. Physical test reports and data are on file at this facility and are available for review by ONR.

  
\_\_\_\_\_  
Gary L. Russell  
Quality Assurance

Distribution: SAIC Test  
SAIC QA  
SAIC Contracts (4)  
SAIC File



SCIENCE APPLICATIONS, INC.  
TECHNOLOGY DEVELOPMENT GROUP (TDG)  
TELEPHONE - SHIPPING/RECEIVING DEPT: (619) 458-3787, 458-3700

SHIPPER CONTROL

NO. 1 2174

FROM:

☐ ELECTRONIC VISION AND SYSTEMS DIVISION  
11526 SORRENTO VALLEY ROAD, SUITE A  
SAN DIEGO, CA 92121

☒ INSTRUMENTATION DEVELOPMENT LAB  
10373 ROSELLE STREET  
SAN DIEGO, CA 92121

☐ RADeCO™  
A DIVISION OF SCIENCE APPLICATIONS, INC.  
10373 ROSELLE STREET  
SAN DIEGO, CA 92121

TO:

Instrumentation Technology Eng. Inc.  
10511 Tucker St.  
Beltsville, MD 20705  
ATTN: Mr. E.C.Aaron

CONTRACT/PURCHASE ORDER NO.

NO0014-82-C-0263

PROJECT NO.

1-131-08-645

DATE DUE

DATE SHIPPED

6-7-84

SHIPPING AUTHORIZATION NO'S.

J. McCoy

SHIPMENT

☐ PARTIAL

☐ FINAL

☒ COMPLETE

NET WEIGHT

GROSS WEIGHT

CUBE

NO. PACKAGES

1

SHIPPED VIA

Air

CARRIER

Emery 04948767

FOB



PREPAID



COLLECT

REMARKS

ITEM NO	PART NO.	DESCRIPTION	UNIT OF ISSUE	QUANTITY AUTHORIZED	QUANTITY SHIPPED
1	131-18-100-000	18mm Quadrant Digicon Guider Tube Assy. s/n 676-5(F-1)	ea	1	1

WHITE - PACKING SLIP  
BLUE - REQUESTOR  
GREEN - ACCOUNTING

CANARY - PURCHASING  
PINK - CONTRACTS  
GOLD - SHIPPING

AUTHORIZED SIGNATURE

DATE

X Gary Mulvaney

6-7-84



SCIENCE APPLICATIONS, INC.  
APPLIED SCIENCE & TECHNOLOGY GROUP  
TELEPHONE - SHIPPING/RECEIVING DEPT.: (714) 452-9150

**SHIPPER CONTROL**

NO. 10469

FROM: Systems Division

☐ ELECTRONIC VISION COMPANY  
526 SORRENTO VALLEY ROAD, SUITE A  
SAN DIEGO, CA. 92121

☐ INSTRUMENTATION DEVELOPMENT LAB  
11526 SORRENTO VALLEY ROAD, SUITE B  
SAN DIEGO, CA. 92121

☐ EFFLUENT CONTROL LAB  
4030 SORRENTO VALLEY BLVD.  
SAN DIEGO, CA. 92121

☐ SAI TECHNOLOGY COMPANY  
4060 SORRENTO VALLEY BLVD.  
SAN DIEGO, CA. 92121

TO:

Instrumentation Technology Engineering, Inc.  
10511 Tucker Street  
Beltsville, MD 20705

Attn: Mr. E.C. Aaron

CONTRACT/PURCHASE ORDER NO.  
N00014-82-C-0363

PROJECT NO.  
1-131-08-645-00

DATE DUE  
12/5/84

DATE SHIPPED  
12/3/84

SHIPPING AUTHORIZATION NO'S.

SHIPMENT

☐ PARTIAL ☒ FINAL ☐ COMPLETE

NET WEIGHT

GROSS WEIGHT

CUBE

NO PACKAGES

1

SHIPPED VIA  
Air

CARRIER  
Federal Express

FOB

Dest

☒ PREPAID ☐ COLLECT

REMARKS

ITEM NO.	PART NO.	DESCRIPTION	UNIT OF MEASURE	QUANTITY AUTHORIZED	QUANTITY SHIPPED
1	131-18-110 000	SHAD Flight Digicon #3 SAIC P/N 131-18-110 000 S/N 674-5 Line Item 0001AF	ea	1	1
2		Copy of Test Data	ea	1	1

OK to Ship Russell 12/3/84



Pete Pettiford 12/3/84  
SP05144



AUTHORIZED SIGNATURE

X *[Signature]*

DATE

12/3/84

1  
PACKING SLIP



<b>MATERIAL INSPECTION AND RECEIVING REPORT</b>		1 PROC INSTRUMENT IDEN (CONTRACT) N00014-82-C-0363		ORDER NO	6 INVOICE NO DATE	7 PAGE 1 OF 1	8 ACCEPTANCE POINT D
		2 SHIPMENT NO SAI0002	3 DATE SHIPPED 84DEC03	4 B/L TCN	5 DISCOUNT TERMS		
9 PRIME CONTRACTOR Science Applications International Corp. 10401 Roselle Street San Diego, CA 92121		CODE 52302	10 ADMINISTERED BY DCASMA - La Jolla Bldg. 4, AF Plant 19 4297 Pacific Highway San Diego, CA 92110		CODE S0514A		
11 SHIPPED FROM (If other than 9: CODE Same as Block 9.		52302	FOB S	12 PAYMENT WILL BE MADE BY DCASMA - Los Angeles 11099 So. La Cienega Blvd. P.O. Box 45011 Los Angeles, CA 90045		CODE S0506A	
13 SHIPPED TO Instrumentation Technology Engineering, Inc. 10511 Tucker Street Beltsville, MD 20705		CODE		14 MARKED FOR Mr. E. C. Aaron		CODE	
15 ITEM NO	16 STOCK PART NO (Indicate number of shipping containers type of container container number)	DESCRIPTION		17 QUANTITY SHIP'D REC'D	18 UNIT	19 UNIT PRICE	20 AMOUNT
0001	AF	The Contractor shall design, build, test and deliver one space-qualified flight model of their intensified quadrant photomultiplier tube.  SAIC Part No. 131-18-110-000 Serial No. 674-5 (F#3) (18 mm Quadrant Digicon Guider Tube Assembly)		1	EA	NSP	NSP
21 PROCUREMENT QUALITY ASSURANCE				22 RECEIVER'S USE			
<input checked="" type="checkbox"/> POA <input type="checkbox"/> A ORIGIN ACCEPTANCE of listed items has been made by me or under my supervision and they conform to contract except as noted herein or on supporting documents.		<input type="checkbox"/> POA <input checked="" type="checkbox"/> B DESTINATION ACCEPTANCE of listed items has been made by me or under my supervision and they conform to contract except as noted herein or on supporting documents.		Quantities shown in column 17 were received in apparent good condition except as noted.			
DATE 34 Dec 84 SIGNATURE OF AUTH GOVT REP TYPED NAME AND OFFICE Pete Petiford S0514A		DATE SIGNATURE OF AUTH GOVT REP TYPED NAME AND TITLE		DATE RECEIVED SIGNATURE OF AUTH GOVT REP TYPED NAME AND OFFICE *If quantity received by the Government is the same as quantity shipped, indicate by (x) mark; if different, enter actual quantity received below quantity shipped and encircle.			

23 CONTRACTOR USE ONLY

MATERIAL INSPECTION AND RECEIVING REPORT		1 PROC INSTRUMENT IDEN (CONTRACT) N00014-82-C-0363		ORDER NO	6 INVOICE NO DATE	7 PAGE 1 OF 1 8 ACCEPTANCE POINT D
2 PAYMENT NO 0003	3 DATE SHIPPED 840CT04	4 B/L TCN		5 DISCOUNT TERMS		
9 AE CONTRACTOR ence Applications International Corp. 01 Roselle Street Diego, CA 92121		10 ADMINISTERED BY DCASMA - La Jolla Bldg. 4, AF Plant 19 4297 Pacific Highway San Diego, CA 92110		CODE S0514A		
11 SHIPPED FROM (If other than 9) CODE e as Block 9.		12 PAYMENT WILL BE MADE BY DCASMA - Los Angeles 11099 So. La Cienega Blvd. P.O. Box 45011 Los Angeles, CA 90045		CODE S0506A		
13 SHIPPED TO strumentation Technology Engineering, Inc. 11 Tucker Street tsville, MD 20705		14 MARKED FOR Mr. E. C. Aaron		CODE		

ITEM NO	16 STOCK PART NO (Indicate number of shipping containers type of container container number)	DESCRIPTION	17 QUANTITY SHIP'D REC'D	18 UNIT	19 UNIT PRICE	20 AMOUNT
1 AE		The Contractor shall design, build, test and deliver one space-qualified flight model of their intensified quadrant photomultiplier tube.  SAIC Part No. 131-18-110-000 Serial No. 691-5 (F#2)	1	EA	NSP	NSP

PROCUREMENT QUALITY ASSURANCE		22 RECEIVER'S USE	
<p><input type="checkbox"/> A ORIGIN</p> <p><input type="checkbox"/> POA <input checked="" type="checkbox"/> B DESTINATION</p> <p>ACCEPTANCE of listed items has been made by me or under my supervision and they conform to contract except as noted herein or on supporting documents.</p>		<p>Quantities shown in column 17 were received in apparent good condition except as noted</p>	
<p>DATE <i>2000</i> SIGNATURE OF AUTH GOVT REP <i>Pete Petiford</i></p>		<p>DATE RECEIVED SIGNATURE OF AUTH GOVT REP</p>	
<p>D NAME Pete Petiford</p> <p>OFFICE S0514A</p> <p>CONTRACTOR USE ONLY</p>		<p>TYPED NAME AND OFFICE</p> <p>*If quantity received by the Government is the same as quantity shipped, indicate by (X) mark; if different enter actual quantity received below quantity shipped and encircle</p>	

ENCAPSULATED DIGICON ACCEPTANCE TESTS (SHAD)

DIGICON NO. 674-5  
F-3

<u>TEST</u>	<u>DATE</u>
4.1 PHOTOCATHODE RESPONSE (QE)	<u>12-3-84</u>
4.2 DIODE ARRAY RESPONSE	
a. Leakage	<u>11-30-84</u>
b. Capacitance	<u>11-30-84</u>
c. $\Delta E/E$	<u>11-30-84</u>
4.3 DIGICON PERFORMANCE	
a. Magnification	<u>11-29-84</u>
b. Error Function	<u>11-29-84</u>
c. Dark Count	<u>11-29-84</u>
d. Uniformity	<u>11-29-84</u>
4.4 PHYSICAL	
a. Diameter	<u>11-30-84</u>
b. Length	<u>11-30-84</u>
c. Centering	<u>11-30-84</u>
d. Weight	<u>11-30-84</u>

Data Distribution:

- ☐ Test Build Log Book
- ☐ Test Lab
- ☐ Tube Engineer
- ☐ Quality Assurance
- ☐ Customer
- ☐ File



12/3/84

TUBE NO. 674-5 F-3  
 DATE 12-3-84  
 (ATP)

PHOTOCATHODE RESPONSE

Visible Current Mode Quantum Efficiency Data Sheet

Wave-length (nm)	Tube Signal (A)	Calibration Standard Signal (A)	Standard Calibration (QE%)	Comments	Calculated QE (%)	Goal QE (%)
360	2.24 <sup>+9</sup>	1.98 <sup>+9</sup>	19.3		24.3	
400	2.05 <sup>+9</sup>	1.43 <sup>+9</sup>	15.4		22.1	25.0
460	1.994 <sup>+8</sup>	592 <sup>+8</sup> 2.48 <sup>+9</sup>	10.5		17.6	
500	1.96 <sup>+8</sup>	1.11 <sup>+8</sup>	7.96		14.1	15.0
560	2.14 <sup>+8</sup>	1.16 <sup>+8</sup>	5.09		9.39	
600	1.79 <sup>+8</sup>	.958 <sup>+8</sup>	3.86		7.21	
660	1.38 <sup>+8</sup>	.724 <sup>+8</sup>	2.52		4.80	
700	1.03 <sup>+8</sup>	.496 <sup>+8</sup>	1.72		3.57	2.5
760	.496 <sup>+8</sup>	.168 <sup>+8</sup>	.726		2.14	
800	.940 <sup>+9</sup>	186 <sup>+9</sup>	.245		1.24	0.1

Test Engineer

E. Wozniak

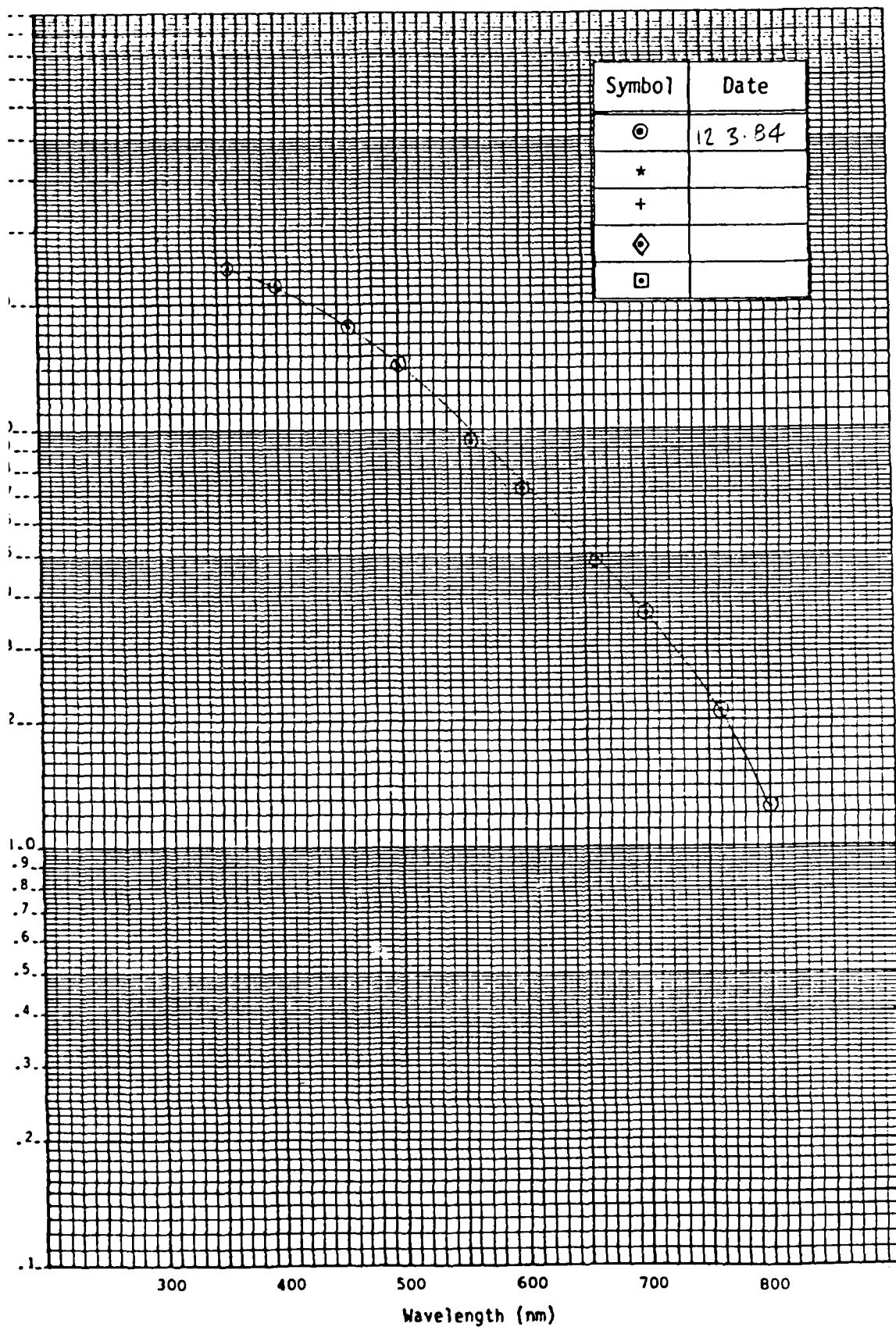
QA



Customer (if applicable)

Calculated QE% =  $\frac{\text{Tube Signal}}{\text{Calibration Standard Signal}} \times \text{Standard Calibration QA\%}$

AT-3018

TUBE NO. 674-5  
F-3

TUBE NO. 674-5 F-3

DATE 11-30-84

QUAD DIGICON ARRAY RESPONSE

DIODE	PIN	LEAKAGE CURRENT (nA) Goal $\leq 1$ nA	CAPACITANCE (pf) Goal $\leq 15$ pf	$\Delta E/E$ Goal $\leq 0.25$
Q1	2	2.4	10.6	0.26
Q2	5	2.08	10.4	0.28
Q3	9	3.0	10.3	0.30
Q4	12	3.18	10.6	0.27
G1	1	.47	7.4	0.23
G2	3	.93	7.8	0.21
G3	4	.45	7.6	0.27
G4	6	.65	7.6	0.20
G5	8	.80	7.5	0.21
G6	10	.62	7.8	0.20
G7	11	.46	7.5	0.26
G8	13	.52	7.8	0.21



ATURE = 0 DEGREES CENTIGRADE

672-5

UBE SCAN

2 / 2 / 83 9 : 55 ( 10 Sec.)  
OUND COUNT FOR 10 INTERVALS OF 1 SEC EACH  
LECTION OF X= 0 & Y= 0  
INC. ACCEPTED = 5  
LIMIT = 100 COUNTS  
ATURE = 0 DEGREES CENTIGRADE

DIODE NUMBER	-----COUNTS-----		
	ISOLATED	FILTERED	TOTAL
1	0	118	118
2	0	96	96
3	0	95	95
4	0	93	93

ILS 402 402

INTERVALS REJECTED; 0 INTERVALS WITHOUT COUNTS

ATURE = 0 DEGREES CENTIGRADE

TUBE SCAN

2 / 2 / 83 9 : 57 ( 0 Sec.)  
OUND COUNT FOR 100 INTERVALS OF 1 SEC EACH  
LECTION OF X= 0 & Y= 0  
INC. ACCEPTED = 5  
LIMIT = 100 COUNTS  
ATURE = 0 DEGREES CENTIGRADE

DIODE NUMBER	-----COUNTS-----		
	ISOLATED	FILTERED	TOTAL
1	0	1118	1118
2	0	975	975
3	0	874	874
4	0	946	946

ALS 3913 3913

INTERVALS REJECTED; 0 INTERVALS WITHOUT COUNTS

ATURE = 0 DEGREES CENTIGRADE

TUBE NO. 672-5  
DATE 2/2/84

SHAD DIGICON DARK COUNT

DO SECOND INTEGRATION

Q1 = 1118  
Q2 = 975  
Q3 = 874  
Q4 = 946  
TOTAL = 3913

C = TOTAL/400 = 9.78

QUADRANT UNIFORMITY

	% AVG
Q1 <u>3750</u>	<u>99.87</u>
Q2 <u>3760</u>	<u>100.13</u>
Q3 <u>3750</u>	<u>99.87</u>
Q4 <u>3760</u>	<u>100.13</u>

AVG = 3755

EST ENGINEER \_\_\_\_\_ QA \_\_\_\_\_

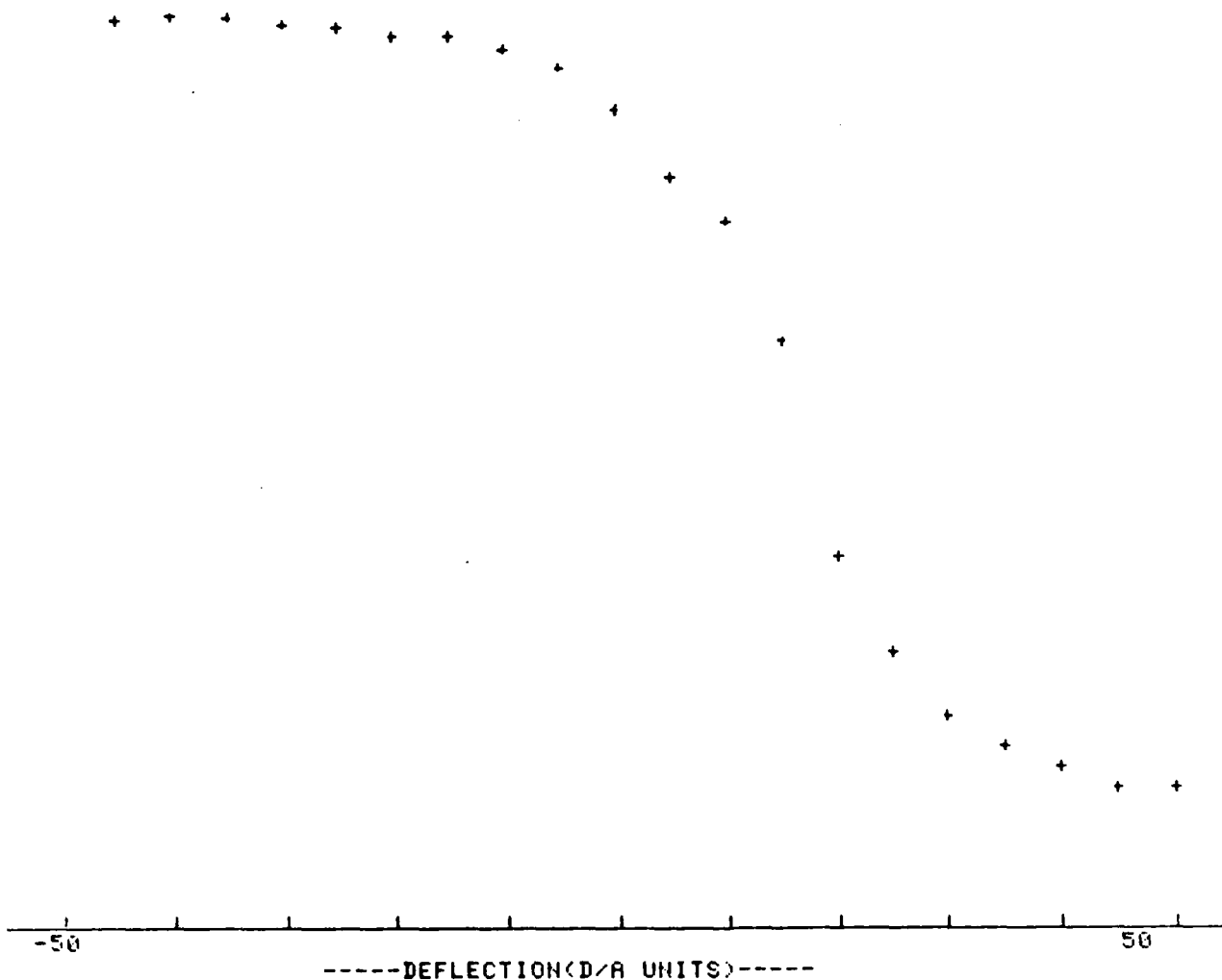


2 / 2 / 83 16 : 12 ( 21 Sec.)  
TUBE SCAN

SP/SEP

672 RESOLUTION  
EEP 0 Y = 0  
-50 TO 50 IN 21 STEPS OF 5 EACH 1 Sec

1P No. 1 COUNTER No. 18 DIODE No. 1 THRESHOLD = 54  
MAX, SCALE MIN = 20000 0



1, Hfm2, FWHM, Pos. = -47.09 16.35 63.44 -15.37  
-90%, 90%-10%, AVE = 3.36 31.05 17.2 = 21.05  $\mu$   
COUNT, MIN COUNT = 20884.4 3374.68

2 / 2 / 83 9 : 34 ( 3 Sec.)  
ID TUBE SCAN

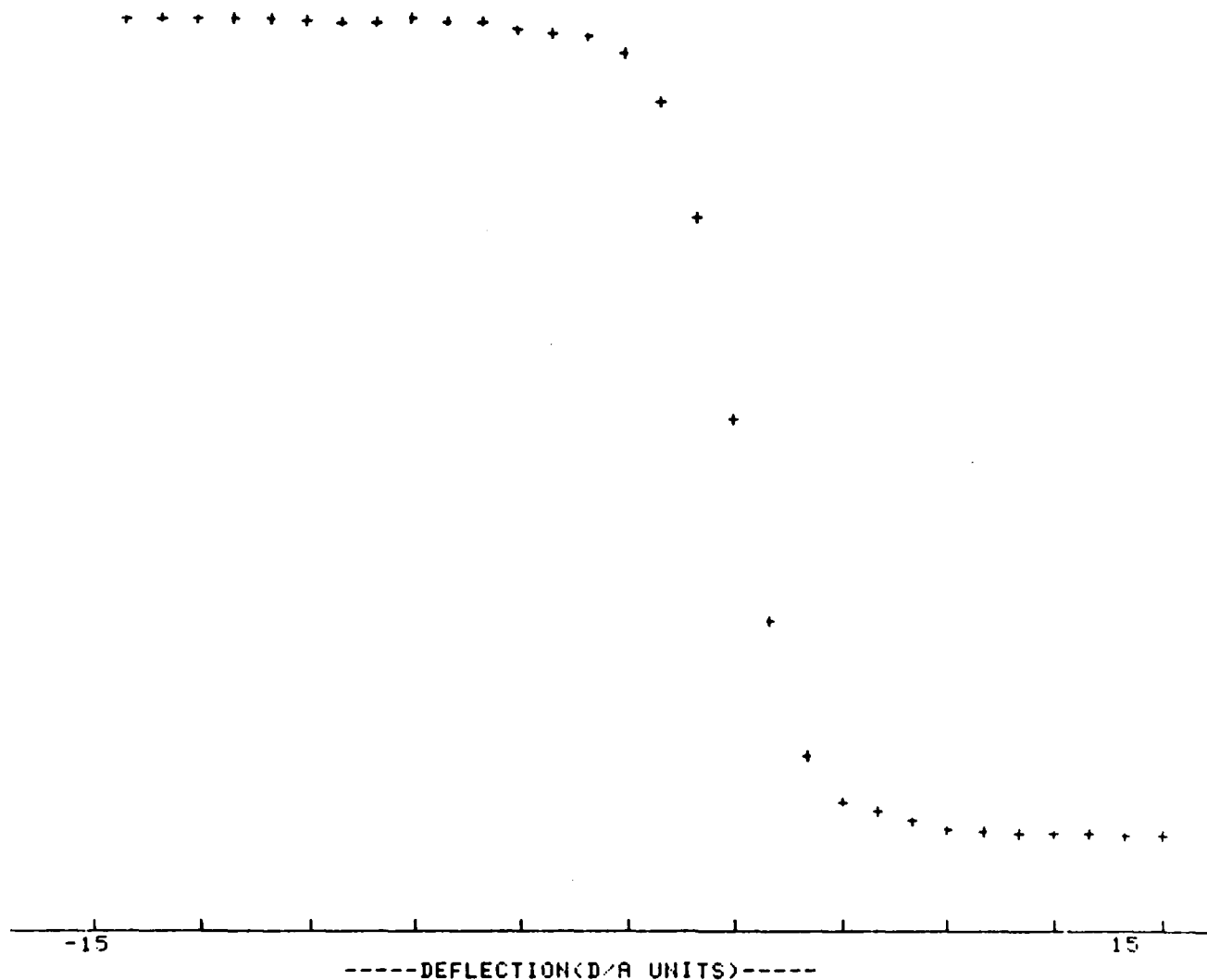
FOR FUNCTION (FINE) 2/2/84

-SWEEP @ Y = -2

DM -15 TO 15 IN 31 STEPS OF 1 EACH 1 Sec

AMP No. 1 COUNTER No. 18 DIODE No. 1 THRESHOLD = 84

BLE MAX, SCALE MIN = 20000 0



m1, Hfm2, FWHM, Pos. = -14.45 3.04 17.49 -5.7  
1%-90%, 90%-10%, AVE = .72 4.04 2.38 RES = 40.4  $\mu$   
IX COUNT, MIN COUNT = 21779.7 2278.21

1 DIA = 10  $\mu$

STD. DEV OF EFUN = .906151062727  
SUMSUM = 2718.4  
MEAN EFUN = .224906928429

TUBE NO. 672-5DATE 2/3/84SHAD DIGICON MAGNIFICATION TESTDIODE 2

	1/2	CENTER	1/2
$\mu$ Divisions	<u>5.4</u>	<u>        </u>	<u>2.2</u>
Count Rate	<u>2925</u>	<u>6000</u>	<u>3065</u>
S (Total No. Divisions)	<u>25 - 5.4 + 2.2 = 21.8</u>		
W = S * ( $\mu$ /Divisions)	<u>= 21.8 * 25.4 = 553.72</u>		
M (Magnification) = D/W	<u>= 400 / 553.72 = 0.722</u>		
(D = Diode Width)			

DIODE         

	1/2	CENTER	1/2
$\mu$ Divisions	<u>        </u>	<u>        </u>	<u>        </u>
Count Rate	<u>        </u>	<u>        </u>	<u>        </u>
S (Total No. Divisions)	<u>        </u> = <u>        </u>		
W = S * ( $\mu$ /Divisions)	<u>        </u> * <u>        </u> = <u>        </u>		
M (Magnification) = D/W	<u>        </u> / <u>        </u> = <u>        </u>		
(D = Diode Width)			

TEST ENGINEER

Acton/McCoyQA

VISIBLE CURRENT MODE QUANTUM EFFICIENCY DATA SHEET

Wave-length (nm)	Standard Calibration (mA/w)/Q.E.	Standard Signal Current (nA)	Calculated Monochromator Out-Put ( $\mu$ W)	Tube Signal Current ( $\mu$ A)	Calculated Q.E. (%)	Spec Q.E. (%)
400 nm	15.4	.644E-9		1.09E-9	24.87	25.0
420 nm		(.616E-9)		(1.02E-9)	(25.5)	
440 nm						
460 nm	10.5	1.46E-9		2.59E-9	18.27	
480 nm						
500 nm	7.96	2.82E-9		.508E-8	14.34	15.0
520 nm						
540 nm						
560 nm	5.09	.306E-8		.578E-8	9.6	
580 nm						
600 nm	3.86	.252E-8		.467E-8	7.15	
620 nm						
640 nm						
660 nm	2.52	.200E-8		.346E-8	4.36	
680 nm						
700 nm	1.72	.142E-8		.238E-8	2.88	2.5
720 nm						
740 nm						
760 nm	.726	.498E-9		.836E-9	1.22	
780 nm						
800 nm	.245	.132E-9		.222E-9	0.3	0.1
820 nm						
840 nm						
860 nm	.017					
880 nm						
900 nm	.002					<0.1

Date Jan 11 1984 Tube S/N: 672-5 Test Eng. Acton

Q.A. \_\_\_\_\_ Q.A. Verification of Equipment Calibration \_\_\_\_\_

PHOTOCATHODE RESPONSE  
Visible Current Mode Quantum Efficiency  
Data Sheet

Tube No. 672-5  
Date 2-8-84

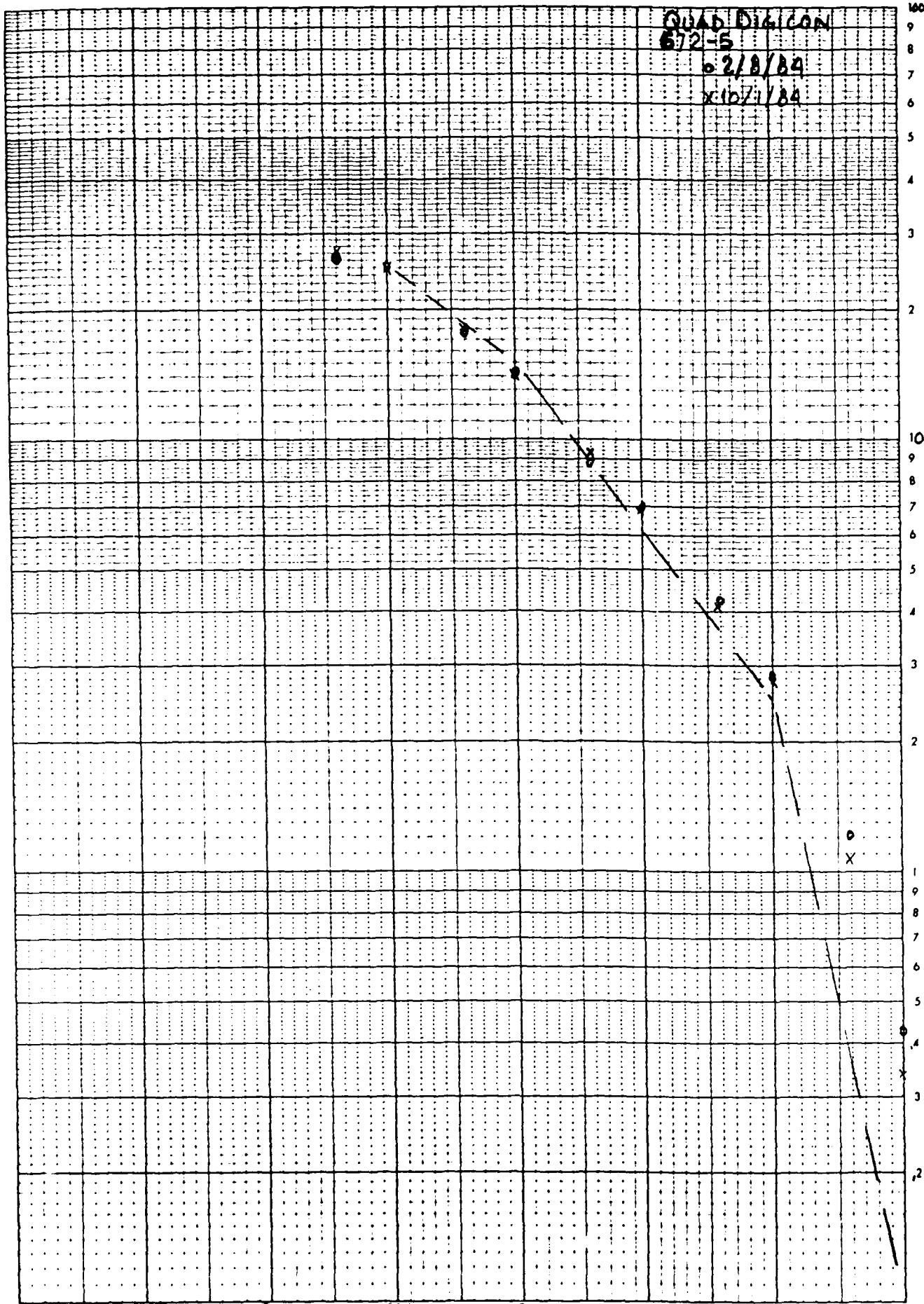
Wavelength (nm)	UUT Tube Signal (A) E	Calibration Standard Signal (A) E	Standard Calibration (QE%)	Comments	UUT Calculated QE (%)	Goal QE (%)
360	.487 -10	.36 -10	19.3	Blue Filter	26.1	
400	.605 -9	.377 -9	15.4	"	24.7	25.0
460	.150 -8	.890 -9	10.5	"	17.7	
500	.305 -8	.173 -8	7.96	no filter	14.0	15.0
560	.352 -8	.201 -8	5.09	"	8.91	
600	.286 -8	.159 -8	3.86	Orange Filter	6.94	
660	.213 -8	.126 -8	2.52	"	4.26	
700	.148 -8	.885 -9	1.72	"	2.88	2.5
760	.514 -9	.308 -9	.726	"	1.21	
800	.148 -9	.85 -10	.245	"	0.43	0.1
<del>860</del>						

Test Engineer J. Acton QA \_\_\_\_\_  
Customer (if applicable) \_\_\_\_\_

$$\text{Calculated QE\%} = \frac{\text{Tube Signal}}{\text{Cal. Std. Signal}} \times \text{Std. Cal. QE\%}$$

QUAD DIGICON  
672-5  
2/8/84  
X 107/1/84

QE  
(%)



UNENCAPSULATED DIGICON TESTS (SHAD)

DIGICON NO. 672-5

<u>TEST</u>	<u>DATE</u>
PHOTOCATHODE RESPONSE	<u><del>1/11/84</del> 2/8/84</u>
DIODE ARRAY RESPONSE	
Leakage (12)	<u>2/10/84</u>
Capacitance (12)	<u>2/10/84</u>
$\Delta E/E$ (12)	<u>2/10/84</u>
DIGICON PERFORMANCE	
Magnification	<u>2/3/84</u>
Error Function	<u>2/2/84</u>
Dark Count	<u>2/2/84</u>
Uniformity	<u>2/2/84</u>

.72

40.4

9.78

5.9

$\pm .1\%$

SERIAL NUMBER 672-5  
UNENCAPSULATED TUBE (SPARE)



TUBE NO. 674-5 F-3

DATE 11-30-84

AT 18-4.4  
Initial Release

PHYSICAL, MECHANICAL DIMENSIONS

a. Maximum Diameter ( $2.00 \pm 0.01$  inch) 2.004

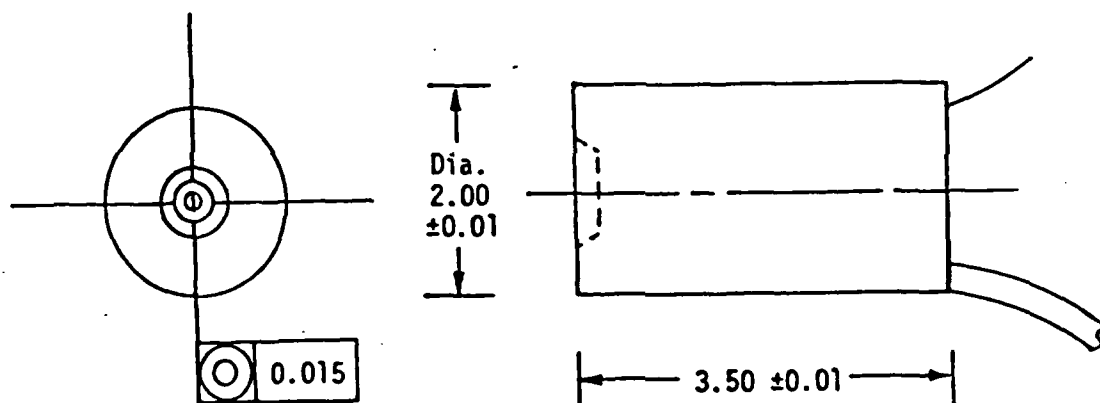
b. Maximum Length ( $3.50 \pm 0.01$  inch) 3.503

c. Concentricity:

Shield, Anticorona Metalization,  
Cone I.D. Optical Inspection

(0.015 max. TIR).....Verified E. V. J. Jr.

d. Weight (Max. 350 g.).....Verified E. V. J. Jr. (290g)



Inspector E. V. J. Jr.

QA

SAIT  
QE4

Customer (if applicable) John Reisinger

John Reisinger



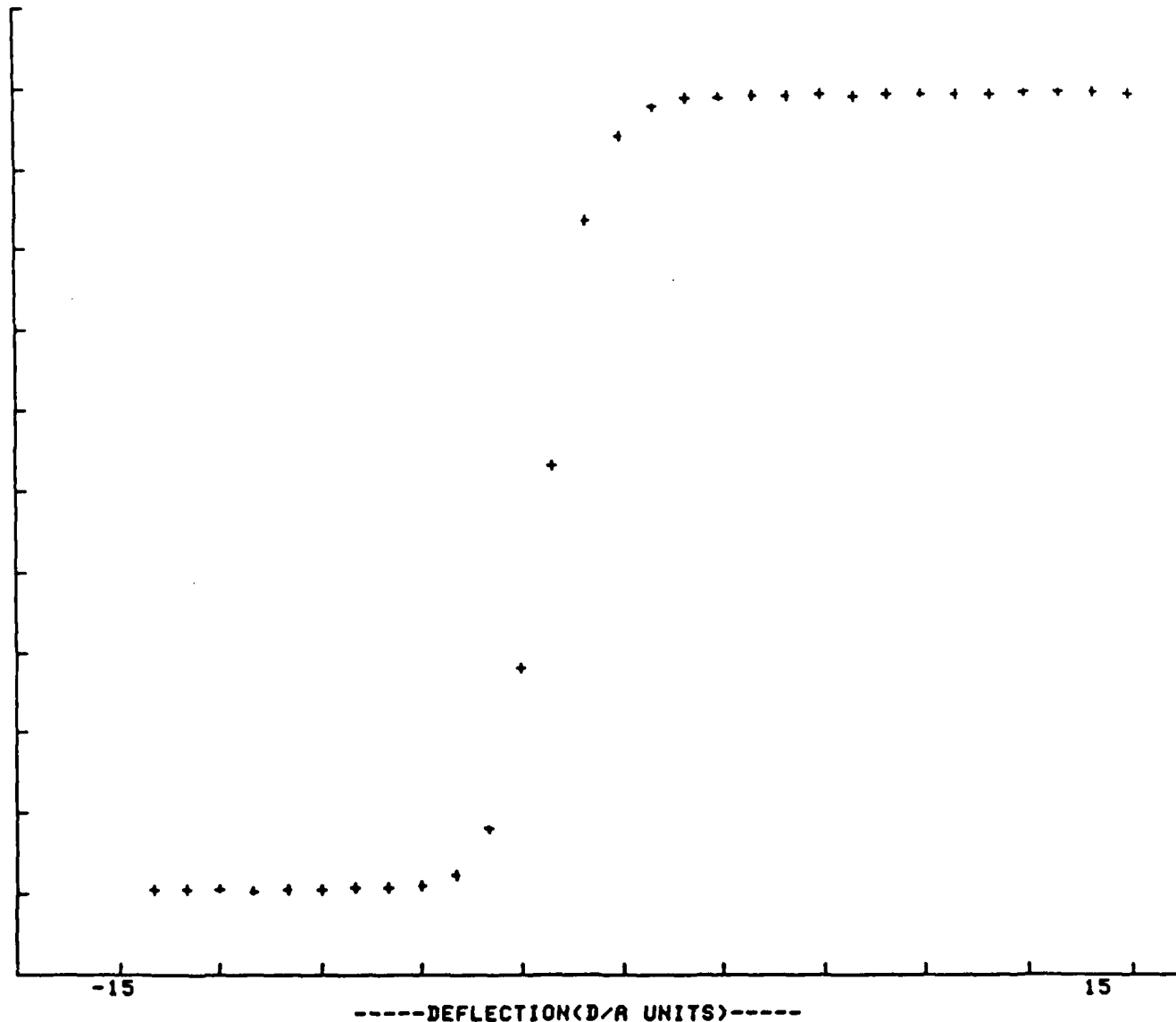
11 / 29 / 83 12 : 29 ( 38 Sec.)  
QUAD TUBE SCAN SHAD F-3 11.29.84

11 / 29 / 83 13 : 49 ( 44 Sec.)  
QUAD TUBE SCAN SHAD F-3 11.29.84

Error Function  
Digicon # 674-5  
F-3

X-SWEEP @ Y = -13  
FROM -15 TO 15 IN 31 STEPS OF 1 EACH 1 Sec

PREAMP No. 1 COUNTER No. 18 DIODE No. 1 THRESHOLD = 54  
SCALE MAX, SCALE MIN = 20000 0



Hf<sub>m1</sub>, Hf<sub>m2</sub>, FWHM, Pos. = -2.19 15 17.19 6.4  
10%-90%, 90%-10%, AVE = 3.69 0 1.84  
MAX COUNT, MIN COUNT = 21927.7 1416.72

36.9  $\mu$ m



STD. DEV OF EFUN = .935928721891  
SUMSUM = 5793.46666667  
MEAN EFUN = .176272619362

*J. Anton*

TUBE NO. 674-5 F-3DATE 11-29-84SHAD DIGICON MAGNIFICATION TESTDIODE Q3

	1/2	CENTER	1/2
$\mu$ Divisions	<u>532</u>	<u>498</u>	<u>464</u>
Count Rate	<u>2953</u>	<u>5720</u>	<u>3320</u>
S (Total No. Divisions)	<u><del>532</del> 464</u>		<u>68</u>
W = S * ( $\mu$ /Divisions)	<u>68</u>	<u>*</u>	<u>10 <math>\mu</math></u> = <u>680</u>
M (Magnification) = D/W	<u>400 <math>\mu</math></u>	<u>1</u>	<u>680</u> = <u>.588</u>
(D = Diode Width)			

DIODE Q4

	1/2	CENTER	1/2
$\mu$ Divisions	<u><del>409</del> 462</u>	<u>492</u>	<u>523</u>
Count Rate		<u>5843</u>	
S (Total No. Divisions)	<u>523 - 462</u>		<u>61</u>
W = S * ( $\mu$ /Divisions)	<u>61</u>	<u>*</u>	<u>10 <math>\mu</math></u> = <u>610</u>
M (Magnification) = D/W	<u>400</u>	<u>1</u>	<u>610</u> = <u>.656</u>
(D = Diode Width)			

TEST ENGINEER

E. J. Jorgin / D. L. Peterson QA

TUBE NO. 674-5 F-3DATE 11.29.84SHAD DIGICON MAGNIFICATION TESTDIODE Q1

	1/2	CENTER	1/2
$\mu$ Divisions	<u>528</u>	<u>494</u>	<u>465</u>
Count Rate	<u>2862</u>	<u>5782</u>	<u>3078</u>
S (Total No. Divisions)	<u>528-465 = 63</u>		
W = S * ( $\mu$ /Divisions)	<u>63 * 10<math>\mu</math> = 630</u>		
M (Magnification) = D/W (D = Diode Width)	<u>400<math>\mu</math> / 630 = .635</u>		

DIODE Q2

	1/2	CENTER	1/2
$\mu$ Divisions	<u>465</u>	<u>434</u>	<u>403</u>
Count Rate	<u>3124</u>	<u>5802</u>	<u>2984</u>
S (Total No. Divisions)	<u>465-403 = 62</u>		
W = S * ( $\mu$ /Divisions)	<u>62 * 10<math>\mu</math> = 620</u>		
M (Magnification) = D/W (D = Diode Width)	<u>400<math>\mu</math> / 620 = .645</u>		

TEST ENGINEER

E. Uzju

QA



**END**

**FILMED**

**5-85**

**DTIC**